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Defeating Its Own Object

THE award of the contract for the reconditioning of the *America* to the Brooklyn Navy Yard is so unfair to the repair plants that we are even able to quote no less a personage than the Honorable Edwin Denby, Secretary of the Navy, as decidedly opposed to such a practice. Secretary Denby in a letter to the *New York American* under date of November 8, 1921, in reference to the efforts of a certain Congressman from the State of Massachusetts to secure the job of reconditioning the *Leviathan* for the Boston Navy Yard said:

"A bid by a private firm *is a guaranty of the performance of the work at a price named and within a time stipulated.*

"A bid from a navy yard *is the estimated cost of the work.* If work is awarded a navy yard after an estimate, *the actual cost of the work is charged,* whether the same be greater than or less than the estimated cost. Estimates ordinarily run fairly close, say within about 10 percent; but in a big reconditioning job where the actual amount of work necessary can only be revealed after opening up the work and uncovering all defects, it is difficult to make an estimate that will fall within 10 percent of the actual cost.

"Furthermore, the stipulated time for performance of work for other departments of the Government must always be subject to the condition *that urgent naval work shall take precedence* even if such precedence causes failure to perform the other Government department's work within the time stipulated.

"As the total cost of reconditioning the *Leviathan* will probably run somewhere between six and eight million dollars, it will be seen that an estimate submitted by a navy yard would not give the Shipping Board the exact information which they desire as to cost and time of performance of this work. The necessity for economy is so great that the authorities of the Shipping Board do not feel that they could take the chance of overrunning the estimated cost by five or six hundred thousand dollars. They must have a guaranteed total expenditure."

As a comment on Secretary Denby's letter we might show many cases where the estimates on various repair jobs approach differences reaching *far nearer 100 than 10 percent* but taking his own figures that the navy estimate might easily be 10 percent under the actual cost we should like to point out in the case of the *America* that the guaranteed price of the Morse Dry Dock and Repair Company was *less than 7 percent in excess of the navy yard estimate.*

This award is a severe blow to the repair plants not only in the case of this one ship but in the precedent that it sets for the reconditioning of other vessels that have been authorized by the Shipping Board. The avowed policy of the board is to seek the advice and cooperation of private shipping interests and eventually dispose of its fleet, under the mandate of the Jones Act, to private capital. How is it going to accomplish this purpose, if the Government sets itself up in competition with the very interests that it seeks to foster?

Evaporators Versus Deadweight

THE savings that can be obtained by the use of an efficient evaporator system on shipboard, as explained by Professor Chapman in his article on page 197 of this issue, are startling to say the least. As his calculations are based on a full deadweight rather than a measurement cargo or, in other words, on voyages where every ton of reserve fresh water displaces a ton of paying freight, it should be noted that his figures do not equally apply to partially loaded ships.

However, as most vessels constantly seek full deadweight cargoes and often obtain them, the question arises as to why evaporators are used only to a very small extent on merchant ships today. We find from Professor Chapman's figures that a saving of $39,360 per annum with a double evaporator

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system and a saving of $35,600 with a single evaporator system is possible on a 10,000-ton deadweight cargo vessel. It is interesting to note that this one saving is at least twice the amount that such a vessel would have received in subsidy under the Merchant Marine Act of 1922 had that measure become a law.

A still more striking comparison is furnished by the total yearly fuel oil bill for the same ship under the same conditions as published in an article on stevedoring costs in the February issue of this magazine. The annual fuel bill is given as $72,500, so, if the owner can save $39,360—54 percent of this cost—or over 100 percent of the fuel bill of an equivalent motorship through increased freight revenue by the use of evaporators, then it is time to inquire whether there should not be some one in the steamship organization whose particular function it is to see that a small saving in one department, such as the fuel consumed in operating an evaporator, is not more than overbalanced by a large loss in some other department.

Is it not the solution in this case that the engineer is not interested in operating evaporators which require considerable attention and apparently add to the cost of the engineering department? We say "apparently" for there are several other gains and advantages which may be credited to evaporators that affect engine room economy. Among these items may be mentioned pure feed water, elimination of boiler scale, increase in rate of boiler evaporation, less boiler blow losses and increased temperature of feed water. Surely this subject is worthy of investigation by shipowners who are not depending on the Government to pay their bills.

The Agamemnon and Mt. Vernon

THE decision of the Shipping Board to authorize the reconditioning of the *Agamemnon* and *Mt. Vernon* marks an epoch in the development of our merchant marine, for it assures us a North Atlantic passenger service equal to that of the Cunard and White Star Lines. And this is not all for the country-wide facilities that a liner company employs to solicit passenger trade are also available for obtaining freight and it may therefore be expected that the successful operation of the United States Lines will find employment for freighters to supplement its passenger vessels.

As we have pointed out many times before, the *Leviathan* could maintain only a one-way express passenger service. At least three fast vessels are needed to insure a regular schedule and the only ships that are both available and capable of making 23 knots are the *Agamemnon* and *Mt. Vernon.*

What is more, the Shipping Board has no authority to construct new vessels, an undertaking that would require several years. They can, however, by adding the *Agamemnon* and *Mount Vernon* to the fleet of the United States Lines greatly increase the probabilities of disposing of the entire line to a private enterprise. The reconditioned vessels would serve their purpose for several years and so make it possible through the development of business to construct new steamers of even a more modern type than any that exist today.

A year ago last January we published an analysis by Carl E. Petersen, naval architect of the United States Lines, showing exactly what might be expected from these vessels in the way of financial returns. In this analysis revenues were estimated at a minimum and expenditures at a maximum and still the balance per annum after deducting expenditures and capital charges was found to be $1,048,000 for the *Agamemnon* and $1,298,000 for the *Mt. Vernon.*

These ships as well as the *Leviathan* should have been reconditioned long ago not only because they would have by this time paid back a large part of their reconditioning costs but also, and of more importance, because their presence in active service would have had a great moral effect in favor of our merchant marine on the American people.

The strength of our position in cargo carrying tonnage is still a long way in advance of our passenger carrying trade. "It seems safe to forecast," said Mr. E. H. Rigg, in his paper before the Society of Naval Architects and Marine Engineers in 1921, "that passenger ship construction will figure somewhat prominently in our bigger and best equipped yards during the next few years, particularly when it is remembered that a considerable number of ships now running would, but for the war, have been out of service ere this and they will need replacement just as soon as practicable." We believe that many shipowners have delayed action pending the determination of a definite Government policy and that the work just authorized on the *Agamemnon* and *Mt. Vernon* is significant as an indication that the time to balance our fleet of cargo vessels with the necessary passenger ships has arrived.

Definite Shipping Policy Still Under Consideration

THE failure of the ship subsidy bill, because of the antiquated rules governing debate in the United States Senate which left a majority of that body impotent in the face of a filibuster by a determined minority, apparently has left the Shipping Board and the administration without a definite policy for transferring the Government fleet to private interests, although one is promised in a few weeks. Probably it is just as well that the board has decided not to act too precipitately in view of the fact that the amount of available tonnage is now such that the recent increase in the export and import business can not be depended upon to maintain the present improvement which has taken place in the rate situation.

After it had become apparent that the bill was dead, Chairman Lasker of the Shipping Board had announced that a "novel and startling" plan for the disposition of the fleet would be made public in a few days and it had been officially stated at the White House that the policy of liquidation would be in effect long before the next Congress meets next December. Before the President and chairman left for Florida on March 5, however, some change occurred which led to an announcement that a committee of the board, consisting of Commissioners Lissner, Thompson and Chamberlain, had been appointed to study and prepare detailed plans "with a view to bringing about, without interruption of service, the passage of the Government's lines into private ownership, in so far as possible." Another committee, consisting of Vice-Chairman O'Connor and Commissioners

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Benson and Plummer, is to make a survey of the physical condition of the fleet as a whole. The President and Chairman Lasker are also reported to be giving some consideration to matters of general policy while on their vacation trip in Florida.

In a general way, three courses are open. The first, continued Government operation of the ships until conditions become such that private shipping interests will be "glad to take them off the Government's hands," was about the only alternative suggested by the opponents of the subsidy bill. They ignored the fact that the present fleet is not properly balanced and would require additional investment as well as heavy expenditures for renewals, to maintain it as a going concern, while its competition would tend to prevent the development of private shipping. Such a plan is not regarded with any favor by the administration, which has no desire to continue to stand the losses inevitably connected with such operation. A second theory is that since the matured policy on which the administration has staked its efforts has failed, the Government should proceed to get rid of its white elephant as speedily as possible. The third, which seems to be the one on which the board is now working, lies between the first two. While representing no committal to a policy of Government operation, it recognizes that it will be practically impossible for the board to liquidate in any short time and that many months, if not some years, will elapse before the Government is actually out of the business of owning and operating ships.

The Jones merchant marine act directs the sale of the ships only "as soon as practicable, consistent with good business methods and the objects and purposes to be obtained by this act." Also it requires the board to take into consideration conditions that would influence a prudent business man in the sale of property "which he is not forced to sell." It may be that Chairman Lasker's "startling" plan was the result of an impression that he was "forced to sell" but that more deliberation suggested other considerations, such as the necessity of maintaining present services and of properly balancing existing fleets before an attempt is made to sell them. It is hoped that new shipping companies will be organized to take some of the services now being operated under MO-4 contracts, but President Smull of the Emergency Fleet Corporation says that no attempt will be made to sell any of the vessels of the fleet now operated by the United States Lines singly until the fleet has been built up to the point of balance regarded by the board as necessary by the addition of the *Agamemnon, Mt. Vernon* and *President Buchanan,* and also the *Leviathan,* now in process of reconditioning. The *Leviathan* will be ready for service this season but work on the other vessels cannot be completed in time for use this season.

It is believed that at least 300 of the 346 steel cargo and passenger vessels now being operated in the berths established by the board will be needed to keep up the services on these routes and that when the board's policy has been definitely outlined an effort will be made to sell these ships which constitute the cream of the fleet, but it may be that further legislation will be considered necessary to make more attractive the terms upon which the ships can be sold or possibly to remove some of the present laws which restrict their successful operation. Even after the detailed plan is announced a good deal of time would necessarily be required actually to complete the negotiations. At the basic rate of $30 a ton comparatively few ships have been sold and the question as to how much below this figure the board would feel justified in going is one of the difficult problems before it.

The board has 320 lake-type ships, under 4,200 deadweight tons, which are suitable for coastwise service and some of these may be sold to foreigners because they can not compete successfully with American ships in foreign trade. Conditions in the oil business may be such as to enable an early disposition of the 80 tankers owned by the board, and there are some 221 steel cargo vessels now tied up which are regarded as suitable for economical operation and salable, if there should be a demand for tonnage, but it is probable that some 400 of the board's ships will be classed as fit only to be scrapped.

The Situation

THE defeat of the ship subsidy bill has not turned out to be such a body blow as many of us expected. Both shipping and shipbuilding prospects are brighter than they have been at any time since the depression started in the fall of 1920. In shipping, the demand for coal, particularly from Germany where substantial contracts have already been placed covering the next three months, has resulted in an advance in freight rates and still further advances are almost certain to occur until additional vessels are sent here from abroad or more of our own vessels are placed in commission. Several coal cargoes have also been fixed for Italy and a few for South America which has also helped to give a much firmer tone to the market.

Passing to the grain market, we can derive considerable satisfaction from the fact that Congress did provide means to finance the farmers and these credits are bound to have a very favorable effect on shipping. We have enormous supplies of grain in this country which can undoubtedly be shipped abroad, if credits can be arranged. It is apparent that a brisk demand for grain would at least maintain if not advance the rates that the recent demand for coal has created.

In this connection we should not lose sight of the growing tendency to ship grain through the port of Montreal whenever that harbor is not blocked by ice. Canadian wheat would naturally pass through a Canadian port but, if the shippers of Montreal get control of the grain market by handling both American and Canadian wheat, they are bound to favor their own farmers whenever possible. Such opportunities actually have occurred; for instance, great quantities of wheat were shipped from Canada through the port of New York in bond during the month of March while our own elevators, and this is particularly true of Buffalo, were stocked to the overflowing point. Probably the tariff on wheat has a great deal to do with this condition as it is but natural for nations to retaliate against any obstructions to the free flow of commerce.

Nor does it appear that the fate of the subsidy bill has discouraged shipbuilding any more than it has shipping. Significant in this respect is the recent report of the Atlantic

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Coast Shipbuilders' Association which gives a total of $5,000,000 as the amount of work contracted for during the months of January and February. In addition to this, the report is authority for the statement that additional orders are in sight that will bring the total up to $15,000,000 by the first of May.

Confirming to a large extent the encouraging viewpoint of the Shipbuilders' Association is the recent statement of the Bureau of Navigation of the Department of Commerce which reports a total of 302,047 gross tons now under construction as compared with 251,858 gross tons on January 1. But by far the most encouraging prospects of the near future lie in the authorized and pending contracts for conversion, repairs and reconditioning. Chief among the new contracts whose consummation has been authorized are the reconditioning of the *America, Agamemnon, Mt. Vernon* and *President Buchanan.* These vessels not only have a direct bearing on the welfare of our shipyards and repair plants but they also will have a tremendous influence on developing and maintaining a first class transatlantic American passenger service.

While on the subject of conversion and reconditioning we would like to call attention to a project on which Admiral Benson is working; namely, the conversion of idle Shipping Board vessels to motorships. Many of these vessels, as is well known, have good hulls but inefficient machinery installations. They are worthless as they are and we have every reason to believe that the Shipping Board will dispose of them—on condition that Diesel engines are installed—at prices that will make it possible to procure motorships in this country cheaper than they may be obtained in any other country in the world.

Diesel engines have proven their reliability and they stand in a class by themselves not as slightly more economical than a steam installation but, according to conservative estimates, they consume only from one-third to one-half the amount of fuel that the most efficient steamer will use. Many authorities think it a crime to use oil under boilers and there is little doubt but that the fixed charges on the additional cost of a motorship over a steamer is the main reason why this type of vessel has not been developed in this country as it has and is now being brought to the front in foreign maritime nations. We believe Admiral Benson is working on the right lines and that the elimination of this differential in first cost through the sale of Shipping Board vessels at nominal figures will stimulate the conversion of a large number of steamers to motorships.

The outstanding feature in new construction during the past year has been the building of coastwise passenger vessels. While a number of these contracts have been awarded nevertheless it is still a fact that the average age of our coastwise passenger ships is still much greater than either the demands of economical operation or the comfort of passengers would permit, if foreign competition were allowed. Of course the replacement of these vessels must occur sooner or later and it is our belief that delay in doing so is principally caused by the mistaken idea that cheaper contracts can be obtained in the future.

No one would contend that shipyards could go on indefinitely taking contracts at ruinous figures but owners usually are reluctant to place new work until prices have shown an upward trend. Such information as has recently been given out by the American Steamship Owners' Association that the idle privately owned American tonnage has been reduced to 10 percent, as well as the common knowledge that the world's idle tonnage has been reduced by 2,000,000 tons in the last year, coupled with the demand that the partial failure of the Mexican oil fields has caused for tankers, the lack of passenger and refrigerator ships and the phenomenal growth of our coastwise trade ought to convince shipowners, particularly in view of the rising market in all commodities, that delay in replacement is bound to be a losing policy.

The shelving of the subsidy bill does not mean that American ships are to be left without Government aid. Chairman Lasker in a recent statement to the press called attention to the fact that the Jones Bill is still operative. And further the declaration in that measure that the Government is in favor of doing what it can to encourage the development of an adequate privately owned merchant marine is by no means idle talk.

As a matter of fact, the Government is in a position without further legislation to grant in many cases what amounts to very substantial virtual subsidies. We refer in particular to advantageous contracts with operators, loans for the construction of vessels with low interest charges, preferential railroad rates to goods shipped in American bottoms, sale of ships at such low figures that the fixed capital charges are practically eliminated, transportation of army and navy supplies and personnel on privately owned vessels, employment of a liberal policy of payment for carriage of mails, which is fully authorized by the Act of 1891, co-operation with the Bureau of Foreign and Domestic Commerce, commercial attachés and utilization of other Government functions, adoption of a uniform bill of lading, establishment of foreign trade zones, establishment of local agencies throughout the country similar to those maintained by railroads and, if possible, the making of arrangements with the railroads for connecting rail and water transportation and many other items, not to mention the use of the same ingenuity and efficient organization that is displayed in other American industries.

We are told that the Shipping Board is now at work preparing detailed plans with a view of bringing about, without interruption of service, the passage of Government lines to private ownership in so far as possible. In the meantime our sailors have been officially advised that the board will continue to operate all of its lines and that it is their duty to carry on in a manner which will make for confidence, efficiency and stability.

The important part of Commissioner O'Connor's message to the seamen, however, was also recently expressed by Mr. Frank C. Munson, president of the Munson Steamship Lines. It is the statement that the American public are actually becoming interested. They are increasing their patronage of American vessels and they are carrying back with them to the inland states a story of wonderful achievement and efficient service. Efficient operation and management we must all acknowledge are of far greater importance to shipowners than any patronage that the Government might bestow.

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Does an Annual Saving of $40,000 Interest You?

Analysis Shows Evaporators Can Save Half of Fuel Bill on Steamers Under Full Deadweight Conditions

By Lawrence B. Chapman*

EVAPORATORS are used only to a very small extent today on merchant ships for producing make-up feed and water for culinary purposes. The common practice is to carry make-up feed in the double bottom tanks; and when evaporators are actually fitted they are, as a rule, used only in emergencies or to supplement the supply of water from the tanks.

Under present trade conditions where most of the cargo ships are sailing with only partial cargoes, or for ships that carry cubic cargoes and are not loaded to the draft marks, the conditions mentioned above are probably economically sound. However, when trade conditions are such that full cargoes can be secured there is a distinct advantage in using evaporators instead of carrying make-up feed as will be shown in this article.

Although the calculations used in this article are based on a 10,000-deadweight ton vessel operating on a 5,000-mile run, the figures given may be easily varied to suit any ship and any radius of action. In this case failure to use evaporators would cause an annual loss of $39,360 in the case of a double effect system and $35,600 in the case of a single effect system. This, of course, is based on the assumption of full cargoes, as the principal gain is due to increased freight carrying capacity. It would have to be modified in the case of measurement or partial cargoes but even then the increased boiler efficiency through the use of pure feed water is worthy of very careful investigation.

Types of Evaporators

There are a number of methods in use of operating evaporators on shipboard as follows:

1. One evaporator (single effect) using high pressure steam.
   (a) Vapor from evaporator shell to main or auxiliary condenser.
   (b) Vapor to distiller and distillate to hot well or tanks.
2. Two evaporators (double effect) using high pressure steam to the coils of the first effect evaporator. The evaporators are operated in series, the vapor from the first effect shell goes to the coils of the second effect evaporator where its latent heat is used in evaporating more water.
   (a) Vapor from second effect shell to condenser.
   (b) Vapor from second effect shell to distiller.
3. Double effect as in No. 2 but fitted with evaporator feed heater. The vapor from the second effect shell goes to feed heater where its latent heat is used in heating the evaporator feed (see Fig. 1). A distiller is seldom used with this arrangement; the condensate from the heater passes directly to feed tank—through a steam trap.
4. Double effect (low pressure type) using low pressure steam (auxiliary exhaust) in the first effect coils. A low vacuum is maintained in the second effect shell and a distiller condenser and air pumps are used.
5. Triple and quadruple effect evaporators. Generally of the low pressure type.

Of the various arrangements mentioned above the first arrangement, consisting of one evaporator without evaporator feed water heater, is the general practice when evaporators are installed in the merchant service. The fourth and fifth arrangements are used in the Navy, where large quantities of low pressure auxiliary exhaust steam are available. These last two types are not to be recommended for merchant vessels because of their complications.

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Operation of Double Effect Type

Arrangement No. 3 should be used on merchant ships instead of the simple single effect evaporator. This type can be operated nearly as easily as the single effect type and the gain in economy is marked. Fig. 1 shows a diagrammatic arrangement of a double effect evaporator with feed heater.

Referring to Fig. 1, the high pressure steam at about 95 pounds absolute enters the coils of the first effect evaporator and evaporates salt water in the shell into vapor at a pressure somewhat above atmospheric. The condensate from the high pressure steam will leave the coils at a temperature slightly below that corresponding to 95 pounds or about 312 degrees F. Evaporators should be operated so that the condensate is not allowed to collect in the coils.

The heat of the liquid q_2 in the condensate is returned to the boiler through the feed tank and it should not be charged against the evaporator. The heat used by the evaporator per pound of steam is, where q_2 = heat in water returned to boiler and $q_1 + r_1$ = heat of water and latent heat of vaporization of steam entering evaporator.

$q_1 + r_1 - q_2 = 294.5 + 890.9 - 282 = 903.4$ B.t.u. per pound.

The vapor from the first effect shell passes to the second effect coils where its latent heat is given up in evaporating more salt water. The distillate from the second effect coils at about 225 degrees F. drains to the main condenser or feed tank.

The vapor from the second effect shell passes to the evaporator feed heater where its latent heat is used in heating the feed water from 60 degrees or 100 degrees to 200 degrees F. The distillate from the heater should drain to the feed tank.

The raw water for evaporator feed is taken from the sea or from the discharge of the main circulating pump and after passing through the coils of the heater enters the shells of the first and second effect evaporators.

Illustrative Problem

In order thoroughly to investigate the relative economy of evaporators, consider a ship with the following characteristics (see article by writer on page 71, February issue):

Length between perpendiculars = 420 feet.
Displacement = 14,600 tons.
Gross deadweight = 10,000 tons.
Speed = 11½ knots.
Shaft horsepower = 2,980.
Geared turbine, watertube boilers, fuel oil.

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Total steam per hour all purposes, excluding evaporators = 37,400 pounds.
Boiler efficiency in service = 70 percent.
Fuel per shaft horsepower per hour without evaporator = 1.00.
Make-up feed (including water for drinking and culinary purposes) = 5 percent.
Radius = 5,000 miles.
Days on run = 19.
Single voyages per year = 11.53.
Pressure of live steam to first effect evaporator coils = 95 pounds absolute.
Vapor pressure shell of first effect = 23 pounds absolute.
Vapor pressure shell of second effect = 14.7 pounds absolute.
Temperature of sea water = 60 degrees F.

Double Effect Evaporators with Heater

Allowing 5 percent make-up feed, the required output of the evaporator is,

$37{,}400 \times 0.05 = 1{,}870$ pounds per hour

or $\dfrac{1870 \times 24}{2240} = 20$ tons per day.

With the calorific value of the fuel equal to 18,700 B.t.u. per pound, a boiler efficiency in service of 70 percent and 1.40 pounds of water evaporated by evaporators per pound of steam, we obtain,

$\dfrac{18{,}700 \times 0.70}{903.4} \times 1.40 = 20.3$ pounds of sea water, evaporated per pound of fuel.

As already noted the heat of the liquid is not charged up against the evaporator as it is returned to the boiler via the feed tank. The above evaporation of 1.40 pounds of sea water per pound of steam is for a feed temperature of 100 degrees F. from the main circulating pump discharge. If an evaporator feed heater is used and the temperature of the raw water increased to 200 degrees F., the evaporation will be increased about 10 percent, giving $20.3 \times 1.10 = 22.3$ pounds of sea water evaporated per pound of fuel.

This evaporation, however, does not allow for the additional steam required for operating the evaporator feed pump. Allowing the salt feed water to be 50 percent in excess of that evaporated (which is the common practice to allow for blow downs), and allowing a lost head through the heater and piping of 35 feet, we have,

$$\text{Water horsepower of evaporator feed pump} = \frac{1{,}870 \times 1.50 \times 35}{33{,}000 \times 60} = 0.05.$$

Allowing 200 pounds of steam per water horsepower per hour for a small direct acting pump the steam used by evaporator feed pump is $200 \times 0.05 = 10$ pounds per hour.

$$\text{Steam per hour to first effect evaporator coils} = \frac{1{,}870}{1.40} = 1{,}340 \text{ pounds per hour.}$$

Increase in steam consumption to allow for feed pump $= \dfrac{10 \times 100}{1{,}340} = 0.8$ percent.

Therefore the actual salt water evaporation per pound of fuel is,

$$\frac{22.3}{1.008} = 22.1 \text{ pounds of water.}$$

The total additional fuel oil required for working the evaporator plant is, $\dfrac{1{,}870}{22.1} = 85$ pounds per hour, or 17.3 tons per voyage.

For a voyage of 19 days the total make-up feed required would be $20 \times 19 = 380$ tons.

With fuel oil at $1.55 a barrel and 338 pounds per barrel the cost of fuel for evaporating the make-up feed would be,

$\dfrac{1.55}{338 \times 22.1} \times 2{,}240 = \$0.465$ per ton of water.

The increase in fuel per shaft horsepower per hour caused by using evaporator is

$\dfrac{85}{2{,}980} = 0.03$ pound per shaft horsepower per hour.

This will make the total fuel per shaft horsepower per hour 1.03 instead of 1.00—an increase of 3 percent.

Comparison of Operating Expenses With and Without Evaporator

(*a*) *Without evaporator*—(Make-up feed carried in double bottom).
Make-up feed water required per voyage = 380 tons.
Net loss in carrying capacity per voyage = 380 — (10 + 18) = 352 tons.
Weight of evaporator installation = 10 tons.
Weight of additional fuel for operating evaporators = 18 tons.
Cost of fresh water for make-up feed at $0.30 per ton = $380 \times 11.53 \times 0.30 = \$1{,}320$ per year.
Loss in cargo revenue at $10 a ton due to feed water carried = $352 \times 11.53 \times 10 = \$40{,}680$ per year.
Total annual loss caused by make-up feed = $42,000.

(*b*) *With evaporator.*—(Double effect type with feed heater.)

Cost of evaporating per year at 46½ cents per ton = $380 \times 11.53 \times 0.465$ =	$2,040
Interest, repairs and maintenance on evaporator plant (7 percent) =	350
Depreciation on evaporator (20 years) 5 percent =	250
Total annual operating charge =	$2,640

Annual gain due to use of double effect evaporator $42,000 — $2,640 = $39,360.
The cost of the 20-ton evaporating plant is made up as follows:

2 cast iron shell evaporators (with automatic feeders)	$1,900
1 feed heater	1,500
1 distiller	700
1 evaporator feed pump	80
Miscellaneous piping and installation	820
	$5,000

The double effect evaporator plant can be piped up so that it can be operated in parallel as two single effect 20-ton evaporators giving 40 tons per 24 hours, if required in an emergency.

The water for culinary and drinking purposes can be obtained from the coil drains of the second effect evaporator and no distiller or distiller circulating pump is necessary. A distiller, however, has been fitted for emergency use and piped up so that the distiller cooling water can be secured from the circulating pump of the main condenser. This eliminates the distiller circulating pump.

Single Effect Evaporator

(*c*) *With Single Effect Evaporator.*—If a single effect evaporator (with emergency distiller) is used without feed heater, the cost of the installation would be about $2,500. One pound of steam at 80 pounds gage would evaporate only 0.78 pound of raw water. One pound of oil therefore will evaporate

$\dfrac{18{,}700 \times 0.70}{903.4} \times 0.78 = 11.3$ pounds of water.

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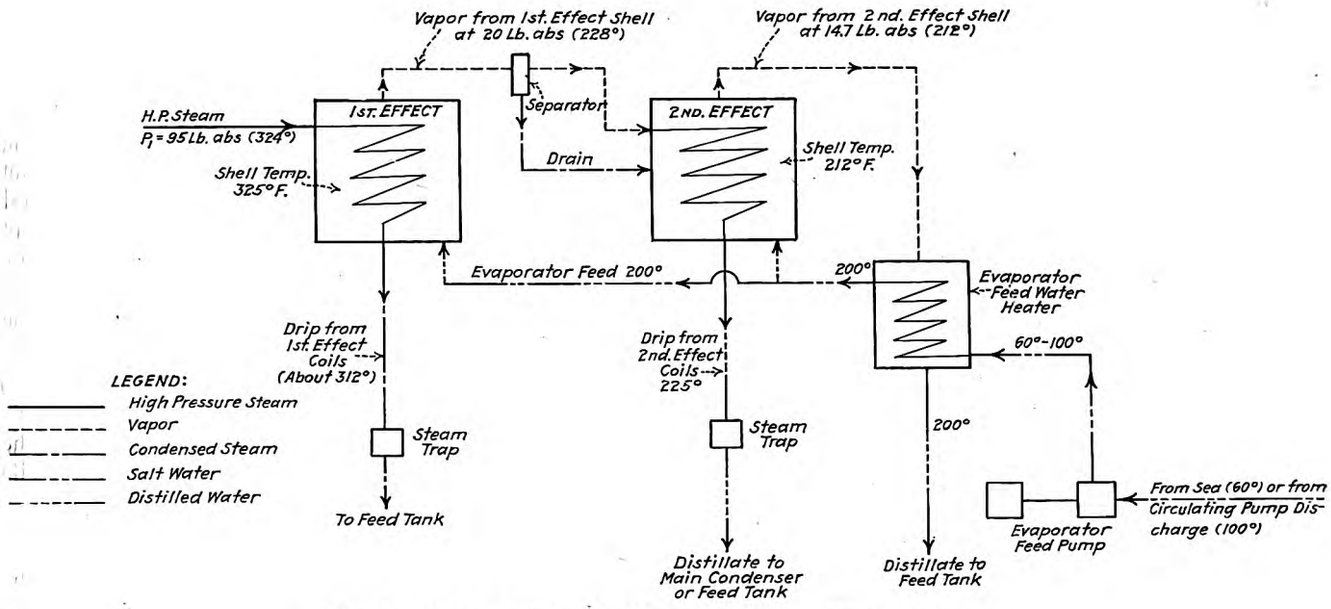

Fig. 1.—Diagram of Double Effect Evaporator Without Distiller

Correcting this for the consumption of the evaporator feed pump we have

$$\frac{11.3}{1.008} = 11.2 \text{ pounds of sea water per pound of fuel.}$$

The additional fuel required per voyage is

$$\frac{1{,}870}{11.2} \times \frac{24 \times 19}{2{,}240} = 34 \text{ tons.}$$

The increase in fuel per shaft horsepower per hour becomes 0.06 pound, instead of 0.03 for the double effect.

$$\text{Cost of evaporating make-up feed} = \frac{1.55}{338 \times 11.2} \times 2{,}240 = \$0.92$$

per ton.

Loss in carrying capacity by carrying feed-water = 380 — (35 + 10) = 335 tons.

Without evaporator:

Loss in revenue per year at $10 per ton = 335 × 10 × 11.53	= $38,600
Cost of feed water per year at 30 cents per ton	= 1,320
Annual loss by carrying feed water	= $39,920

With evaporator—(single effect):

Cost of evaporating make-up feed per year at 92 cents per ton, 380 × 11.53 × 0.92	= $4,020
Interest, depreciation and maintenance (12 percent)	= 300
Total annual operating charge	= $4,320

Annual gain due to use of single effect, $39,920 — $4,320 = $35,600.

The single effect evaporator, therefore, shows an annual gain of $35,600 as compared with $39,360 for the double effect evaporator.

The above calculations show that there is a gain of $3,760 a year in favor of the double effect evaporator as compared with the single effect evaporator.

Conclusions

The foregoing calculations show that when full cargoes can be secured there is a marked gain in annual income by using double effect evaporators in contrast to carrying make-up feed. Fresh water has been taken at 30 cents a ton which is the average cost in American ports. If water runs as high as 50 cents a ton, as it frequently does, the cost of water and evaporation are about equal.

When evaporators are used there are several additional gains and advantages chief of which are the following:

(1) Pure feed water and the elimination of boiler scale which results in a higher boiler efficiency and reduced repair and cleaning charges.
(2) Increase in the rate of evaporation in the boiler can be allowed due to the pure feed water.
(3) Elimination of boiler blow losses.
(4) Increase in temperature of water in feed tank due to high temperature of evaporator drips. In the above double effect installation the make-up feed enters the feed tank at about 200 degrees instead of 60 degrees. This increases the temperature of the feed and filter tank,

$$\frac{1{,}870\ (200 - 60)}{38{,}750} = 6.7 \text{ degrees.}$$

With 250 pounds pressure and 100 degrees superheat at the boiler, the British thermal units per hour required are,

$$38{,}750 \times 1{,}264 = 49{,}000{,}000 \text{ B.t.u. per hour.}$$

The British thermal units increase at the feed tank is

$$1{,}870 \times (200 - 60) = 260{,}000 \text{ B.t.u. per hour.}$$

This results in a gain in plant efficiency of 0.5 percent.

Operation Practice on Merchant Ships

In order that evaporators function properly it is necessary that the salinity of the water in the shell should not exceed 3/32. This requires regular blow-downs either continuously or intermittently of about one-half of the amount evaporated. The general practice is to blow continuously and to fit regulator valves that maintain a constant level in the shell. This results in a constant salinity of about 2½/32.

If self-scaling evaporators are used, such as the Reilly type with submerged coils, the coils can be kept free of scale by emptying the evaporator, according to their instructions, once each watch. When evaporators are operated on the above plan, double effect evaporators are as easy to take care of as the single effect type and the economy is practically double.

The condensate and distillate and drips from the coils should always be sent to the feed tank where the heat of the liquid can be saved. They should *never* be allowed to go to the main or auxiliary condenser.

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Chamber of Shipping Discusses Maritime Situation

Recent Contracts for New Vessels in British Yards Unprofitable—Shipowners Faced With Additional Burdens—Shipping Depression Continues

By W. H. Wendon

THE past few weeks have produced topics of unusual interest to shipowners in the United Kingdom and abroad, for in the period under review the annual meeting of the Chamber of Shipping of the United Kingdom, the leading maritime body in the country, has been held. The subjects discussed have, as usual, been of importance befitting the occasion. Let us take, first of all, the situation which has arisen with regard to the recent placing of contracts for new vessels.

In the late autumn, it will be recalled, many shipowners took their courage in their hands and contracted for ships, presumably in the belief that the slump was ending, if, indeed, it had not already been passed. But it has since transpired that these contracts were placed at figures which —certainly from the point of view of shipbuilders, if not from that of shipowners themselves—precluded the contracts resulting in a profit. The position may be summarized as follows: There are shipowners who would not be averse to contracting for new boats in the neighborhood of £8 to £8 10s. per ton on the deadweight, but they definitely refuse to go higher than these quotations. Many contracts recently placed, it may be mentioned, were at figures between £8 10s. and £9 5s. If, then, shipbuilders are going to lose on the orders already placed, it is patent that, if contracts were accepted at owners' present views, the losses of builders would be still further increased, for in the meantime their costs of production have not materially diminished. This, then, must be held to account for the slackening off which has been apparent in the placing of new orders, coupled, of course, with the hitherto non-materialization of the "boom" in shipping.

Shipping Depression Not Yet Ended

This method of reasoning is substantially on the lines of the arguments put forward by Sir Ernest Glover, the newly-elected president of the Chamber of Shipping, for at the gathering to which I have already referred he told his listeners that the first reflection which must occur to all is that the period of depression from which the shipping industry has been suffering for so long is not yet at an end. Twelve months ago the then president of the Chamber expressed the opinion that things were so bad that they could not very well get any worse, but the past year, in Sir Ernest Glover's view, has proved that, however deep the abyss may be into which shipping has fallen, there is always the possibility of the bottom of the abyss dropping out. Lest he should be thought to be exaggerating in making this statement, he gave the reminder that in several of the main trade routes of the world, rates of freight in 1922 were less than half the average rate of 1921, which was a bad year. On the other hand, there have been some reductions in running costs, but nothing which can compensate for such a fall in freights as has occurred. Taking the market value of ships today, and comparing it with the value even a year ago, Sir Ernest Glover fears that it must be recognized that there has been a very material shrinkage.

The new president's outlook for the future is not particularly rosy. He recalls that during last autumn shipowners saw a ray of light on the horizon, owing to an improvement in some markets, especially in the East, which had persistently maintained an attitude of extreme depression. This improvement, and a reduction of shipbuilding costs, induced a good many owners to take heart and order new steamers. Builders were anxious to get work to enable them to keep their yards going and their staffs together, and no doubt they did accept work on very moderate terms, in view of the present level of costs of production—in fact, terms offering little or no prospect of profit. The hope of the late autumn gradually waned as the winter progressed, and Sir Ernest Glover ventures to consider that the outlook today is not nearly so promising as it was three or four months ago. Nevertheless, although his remarks may be regarded as pessimistic, he claims to be no pessimist. No shipowner, he holds, can be a pessimist. If he is, he must cease to be a shipowner. He believes in a sane optimism which does not underrate the difficulties, but decides to meet them with courage and with a determination to win through, "and so reach the smoother waters which shipowners hope and believe lie ahead."

Shipbuilder Deplores Building Vessels at a Loss

Turning from the shipping position as seen through the eyes of a shipowner, it is not without interest to study the situation as it reveals itself to a front-rank builder of ships. Sir Alexander Kennedy, the authority to whom I am referring, is the chairman of the Northumberland Shipbuilding Company, Ltd., an important North of England concern, and his views at all times receive respectful consideration, both from his fellow shipbuilders and from shipowners. Apropos the present position, he does not mince matters. Frankly, he deplores what he describes as the tendency on the part of shipowners of expecting ships to be built at a loss, and he emphasizes the necessity for shipbuilders receiving reasonable remuneration for their work, pointing out the hampering effects of high costs of raw materials. He feels that at the present time the shipbuilding industry is at the cross-roads, and makes reference to "the slight flow of orders" in recent months—enough to give employers and workmen a chance to prove themselves. He maintains, however, that there is a definite limit to the extent to which shipbuilders can incur the risk—he might almost say the certainty—of loss.

Ships taken recently have been at prices which certainly cannot be repeated without a change of circumstances; shipbuilders, he says, have no desire to raise prices, but they cannot reduce them further in the present circumstances, or, he fears, for a long time to come. He feels that there is a tendency on the part of shipowners to place too heavy a burden upon shipbuilders and their workmen, and that there are some who expect builders to construct ships at a loss in order that they (the shipowners) may run the vessels at a profit. In conclusion, Sir Alexander Kennedy considers that, while the total price of ships has no chance of being further reduced for a long time to come, there must be an internal adjustment, "to give the builders a chance of receiving reasonable remuneration." It is not sound business, he says, to fill yards at present prices, nothing would be more disastrous than an appreciable rise in the price of new ships, and he trusts that, in spite of what has occurred on the Continent, coal owners and steel makers realize that an increase in the price of raw materials for the industry is bound to have a

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hampering effect and completely stop any chance of trade recovery.

ADDITIONAL BURDEN FOR SHIPOWNERS PROPOSED

The shipowners of the United Kingdom are face to face with a new trouble revolving round what is regarded as an "economy stunt." The Board of Trade has framed certain definite proposals with a view to their being incorporated in a new Parliamentary Bill. It is proposed, inter alia, to raise the fees for tonnage measurement and for the yearly survey of passenger ships, and also to prescribe fees for signing on and signing off crews. The general effect of the proposals, it is felt, will be to shift the burden on to the shoulders of the shipowner from the Government Department concerned.

The Board of Trade recommendations arise from the "Economy Report" issued twelve months ago by the Geddes committee, dealing, among other things, with the mercantile marine services. One of the committee's recommendations was that the department should be rendered self-supporting by reducing the cost and charging shipowners additional fees in connection with the engagement and discharge of seamen. The report stated:

> "The Mercantile Marine Offices were originally started in 1850 with the idea that they should be self-supporting by fees levied for engagement and discharge of seamen, but these fees, which amounted to, roughly, £70,000 in 1882, were abolished by the Board of Trade in that year. In 1892 Parliament took away from the Board of Trade their power to charge any fees in connection with engagement and discharge at a mercantile marine office. There is now no power, therefore, under the Merchant Shipping Acts to levy fees for the engagement and discharge of seamen in the United Kingdom, but fees are paid by the shipowner, if the engagement and discharge takes place on board ship at the request of the shipowner."

The total number of engagements and discharges of seamen per annum is approximately one million, and the committee recommended that the service should be rendered again self-supporting as it was prior to 1882 after certain steps had been taken for reducing the cost of the organization.

So much for this measure in broad outline. Shipowners resent the scheme whole-heartedly. Indeed, they feel serious apprehensions at the suggestion that, in addition to existing burdens, the shipping industry is to be saddled with the cost of carrying on an expensive government department, over the operations of which it has no control whatever. Shipowners point out that they pay very substantial fees for surveys, tonnage measurement, and so on, as a contribution towards the expense of this department, and they make no complaint of that. But they feel that they are entitled seriously to challenge the suggestion that these fees for surveys, etc., should, roughly speaking, be quadrupled, and that, in addition, the mercantile marine offices at the ports should be maintained by charging the shipowners 2s. 6d. for every man signed on or paid off.

It is estimated that the effect of the Government's proposals will be at once to throw an additional charge of about £400,000 per annum upon the shipping industry. Shipowners believe the principle upon which the Government is proceeding to be entirely wrong, and express the hope that it will think again before it places what they (the shipowners) deem to be so dangerous a precedent upon the Statute Book.

FOREIGN TAXATION OF SHIPS

Another matter which is receiving the close attention of shipowners is in regard to the taxation of ships in the countries to which they may happen to be trading. And this is a subject with which the United States is very intimately associated. It is conceded here that it is an unchallengeable fact that Great Britain in 1916 took the step of making foreign ships using her ports pay income tax. The immediate result was retaliation, and, from the British point of view, so serious has the matter become that two liner companies alone, in the course of one year, paid no less a sum than £160,000 sterling in income tax to the United States Government.

In November, 1921, the International Shipping Conference, attended by delegates from every country possessing a merchant marine worthy of consideration, carried a resolution expressing, inter alia, "the desirability, in the interests of international trade, that legislation be encouraged in every maritime country in the world giving immunity from taxation in respect of the earnings of foreign shipping in all cases where such immunity is reciprocally given." In the same month the United States Defense Act became law, and contained a clause which gave effect to the principle for which the Chamber of Shipping and the International Shipping Conference had contended. The clause provided that no income tax should be payable in the United States of America upon profits of ships belonging to countries which gave similar exemption to the United States.

It is felt in United Kingdom shipping circles that this question of taxation abroad has reached such a level that steps should be taken to induce the British Government to accept what is generally regarded as America's fair offer. It is urged, moreover, that the Government would be well advised to accept the offer *now*.

One aspect of the matter which, in present conditions, is regarded as the most serious is that shipowners are taxed on profits beyond the measure of real profits, and even when real profits do not exist. It is emphasized that, unless this "pernicious" taxation system is nipped in the bud, a race may be seen between different countries as to who can extract the most from the shipowners. And the retaliation which may result from such a race may be easily pictured. The view of Sir Ernest Glover is that anything of the kind is much to be deprecated, and can only tend to hamper trade, while the increased costs being thrown on the shipowner must eventually be reflected in the rate of freight charged, to the prejudice of the country imposing such taxation.

WAGE REDUCTION OF BRITISH SEAMEN TO BE CONSIDERED

Every effort continues to be made to bring about reductions in steamship operating and working costs. There has, it is true, been an amelioration in dock and similar charges during the past year, but it is felt in shipowning circles that these reductions will not bear fruit in a revival of trade prosperity unless they are followed up by further substantial reductions in all charges incident to overseas transport. The item regarding which the greatest anxiety is experienced is in regard to wages. In the first place, British seamen's wages are still about 100 percent more than was paid before the war. It is, therefore, scarcely surprising that when, for example, dock workers are approached with a view to lowering their wages, they reply in effect: "Put your own house in order first"—in other words, bring down the wages of seamen.

This matter of reducing seamen's wages in Great Britain is to receive the serious consideration of those concerned, but it is appreciated that the position is an extremely delicate one. In this connection some remarkable statistics have been prepared by the Chamber of Shipping comparing the wages paid in this country and in Germany. Thus, the monthly wages and salaries of German officers and crew are as follows, the equivalent value in English money being given: First officer, £2 9s. a month, as compared with £18 10s. to £25 in this country; first engineer, £3 1s. 10d., as compared with £21 to £24 in this country; able seamen, £1 9s. 3d., against £10. Almost without exception, wages in Great Britain are the highest today in any maritime country in the world.

CONTINUOUS EMPLOYMENT OF SEAMEN DESIRABLE

An improvement in the method of employing seamen is one of the interesting subjects which have arisen during the past month. Sir Ernest Glover is responsible for bringing the matter to public notice. The system by which men are

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signed on for the voyage is, he holds, eminently unsatisfactory, as employers never get to know anything of the men, and similarly the men know nothing of their employers. There is thus little or no chance of employers and employees taking a mutual interest in each other. But without an alteration in the law it would be impossible to make employment continuous, for not only is the sailor entitled to be paid off at the end of the voyage, but the owner is entitled to pay him off, and thus the practice has been established. Sir Ernest Glover, therefore, suggests the possibility of devising a scheme whereby employment might be practically continuous.

The difficulties which would certainly arise are not lost sight of: For example, steamers, for some reason or other, might be laid idle for a considerable period, during which the crews would of necessity have to be paid off. It would, therefore, be necessary to have a clear understanding that men signing on would be available for working ships in port, and the scheme would have to be adopted by all shipowners, if success was to be achieved. The advantage to shipowners would, it is thought, accrue by saving riggers and shore gangs while in port, and, if reductions are to be made in wages, it is felt that the negotiations would be easier, if the reduction were coupled with some arrangement whereby the practical continuity of work could be relied upon.

Society of Naval Engineers Holds Annual Banquet

Secretary Denby Outlines Salient Features of Naval Policy and Secretary Hoover Urges Standardization of Business Methods

THE annual banquet of the American Society of Naval Engineers was held at the New Willard Hotel, Washington, D. C., on February 27. Among the prominent speakers were Edwin Denby, Secretary of the Navy; Herbert Hoover, Secretary of Commerce, and Admiral R. E. Coontz.

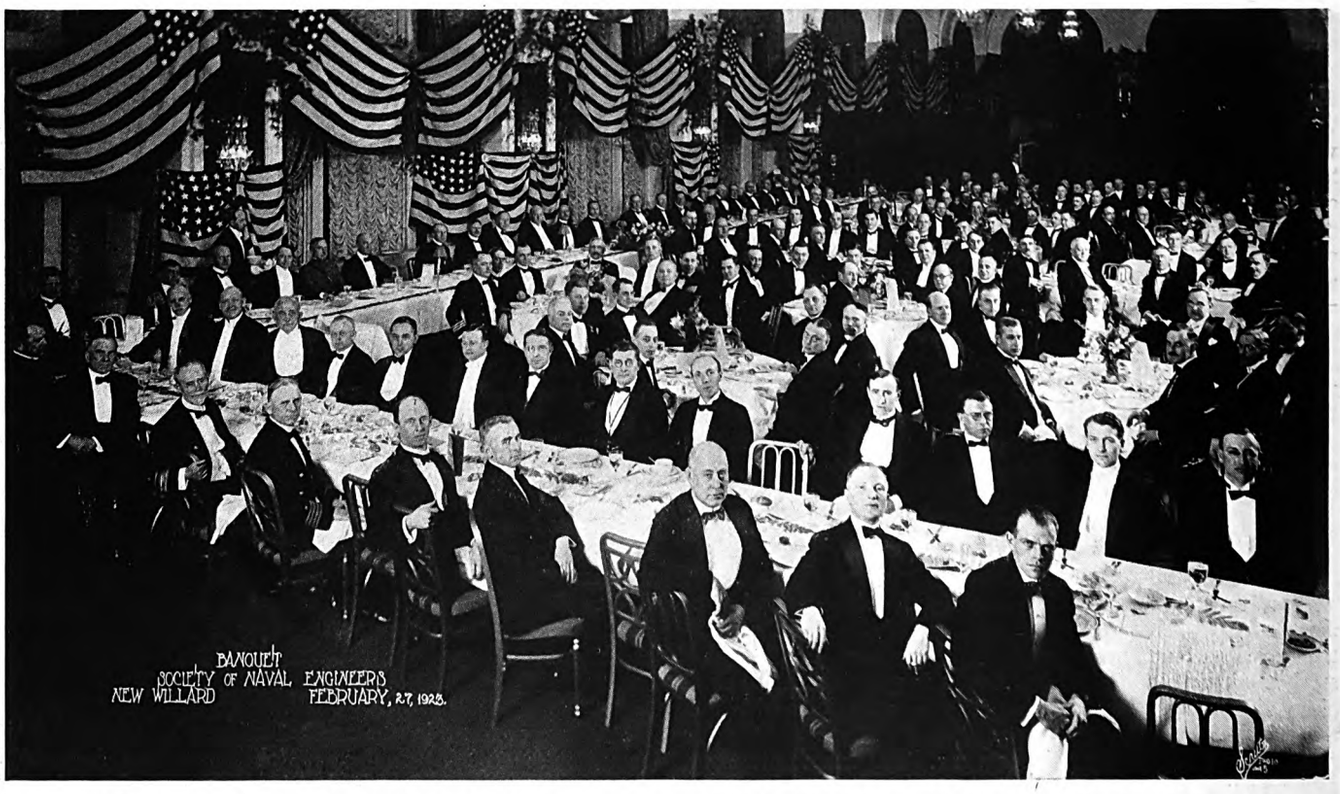
In speaking of the work accomplished by the Navy during the past two years, Secretary Denby pointed out that it was the policy of the Administration to maintain our Navy at sufficient strength to protect our overseas possessions. The Navy, he said, exists to guard commerce and to provide national security. In addition to this, he declared it does a large amount of humanitarian work of which Smyrna is an example. The time of haphazard establishments and shore policies has passed, the Secretary said, and in its place great fleet bases have been built up.

Secretary Denby pointed out that the policy of keeping oil underground for the future use of the Navy has resulted in many cases in the oil being drained off rapidly from neighboring fields. The Administration, therefore, had transferred the responsibility for an adequate naval oil supply to the Department of the Interior. Tank space has been reserved where oil may be placed in storage in order to insure conditions that would adequately serve the Navy in times of emergency.

Fleet Mobilization

The grand United States Fleet has been created, the Secretary declared, along lines similar to that practiced by other nations and almost all vessels of any consequence have been included in this fleet.

We are trying, Secretary Denby said, to get a bill through Congress that will put our Naval Reserve on a fixed basis.



Annual Banquet of the Society of Naval Engineers at the New Willard Hotel, Washington, D. C., February 27

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He was sorry to have to say that we had only a skeleton reserve at the present time. In regard to the enlisted personnel he thought there could be an amelioriation of punishments in many cases. This subject he said has been given much study as problems concerning the enlisted men were very close to his heart.

Re-establishment of Credit and Transportation

Secretary Hoover spoke of the work that naval officers had done in assisting in the re-establishment of credit and transportation after the war. He said that they had called upon the Navy to detail some 30 or 40 officers and had then given these officers instructions that they wanted the seaports opened. Thousands of tons of material had been sent into foreign ports under the direction of these officers and in his estimation never had arrangements been made with more businesslike precision.

Simplification of Business Methods

There is a realization, declared Secretary Hoover, that there must be simplification in our business methods. We have relied upon mass production but we need to make further progress in the replacement of parts which means a greater simplification.

The Navy gives a moral background, the Secretary asserted, that will provide the encouragement to undertake marine and commercial ventures. It gives a feeling of security to American commerce and is a cheap form of insurance.

60,000 Men at Sea

Out of the 86,000 men that Congress has allotted to the Navy, said Admiral R. E. Coontz, 60,000 are at sea. One of the greatest things in the world is morale and it was feared that the reduction in naval personnel would injure it but he was glad to say that it did not.

Speaking of the mobilization into one fleet, Admiral Coontz pointed out that the Commander-in-Chief was in this way relieved from many petty details and could exercise his brains on strategy. The Pacific ocean, he said, would be the most important in the future and plans had been made for a great base on that coast and other minor bases all the way down from Alaska to Hawaii.

A Survey of Philippine Shipping Conditions

American and British Ships Share Trade About Equally—Japanese Vessels Dropping Behind—Extension of Coastwise Law Discussed

By Vicente Villamin

LIKE Coue's formula for a happy life shipping conditions in the Philippines are getting better and better. More and better equipped steamers, both passenger and freighters, are now giving improved and speedy service. Healthy competition and the reviving foreign trade are the two determining factors in the situation.

The trade for 1922 amounted to over 359,000,000 pesos, registering a balance of approximately 25,000,000 in favor of the Philippines. The bulk of the trade was done with the United States, it being valued at 224,000,000 pesos, of which 128,000,000 was exports and 96,000,000 imports.

British ships led in the volume of the trade carried, the American coming a close second. Cargoes valued at 135,500,000 pesos were moved in British bottoms as compared with 132,200,000 pesos in American. In 1921 the proportion stood at 169,700,000 pesos British and 139,000,000 pesos American. Of a total of 1,272,779.77 tons engaged in ocean shipping, 448,971.42 was British and 405,273.01 American. It will be seen therefore that American vessels carried the largest volume of the trade on the basis of relative size of tonnage. In 1920 the American tonnage was 579,164.41, British, 399,094.56 and Japanese, 328,092.74. Of course, American vessels from 1918 to 1920 transported the bulk of the trade. Japanese vessels on the run are being pushed more and more behind.

How Trade Is Divided

Specifically taking up the trade between America and the Philippines, official figures show that during the first 11 months of 1922, 75 percent of the imports from the Pacific Coast and 15 percent from the Atlantic Coast were carried in American vessels. Regarding exports, 67 percent to the Pacific Coast and 45 percent to the Atlantic Coast were carried in American ships. With the allocation by the Shipping Board of more tonnage to the Atlantic-Philippine trade American bottoms will undoubtedly take away proportionate cargo from the foreign lines.

During the period under review 956 first and 6,600 third class passengers sailed from Manila to the Pacific Coast, including Honolulu and Vancouver. During the same period in 1921 there were 959 first and 4,571 third class. During 1921, 57 percent of all passengers traveled in foreign vessels and 43 percent in American vessels. In 1922 the position was reversed, being 54 percent for American and 46 percent for foreign vessels. Members of the Army and Navy are excluded. Their travel is taken care of by the army transport service. The showing of American passenger steamers cannot be but highly encouraging, especially in view of the fact that the most commodious and the fleetest liners on the run are the Empress greyhounds of the Pacific operated by the Canadian Pacific Steamship Company.

American Mail Service Predominates

In connection with mail service, the United States Government paid during the fiscal year $744,741 to American vessels and $163,633 to foreign. The American payees were the Admiral line, Oceanic (Spreckles), Pacific Mail Steamship Company, the China Mail Steamship Company and others whose contracts amounted only to $4,200; and the foreign were the Union Steamship Company, Toyo Kisen Kaisha, Osaka Shosen Kaisha, Nippon Yusen Kaisha, Canadian Pacific and others which received a total of $17,545. It should not be overlooked that the payments were made for mail service between America and the entire Far East.

Besides Cebu and Iloilo new ports have been made ports of call for ocean-going steamers thus obviating expensive trans-shipment in Manila. In this service Shipping Board steamers lead. This is a matter of general congratulation.

During the past year steamers under the German flag took their places in the trade after an absence of eight years. A new line, the Hugo Stinnes Far Eastern Services, has been added. The Canadian Pacific placed two additional steamers on the Vancouver-Hongkong run, connecting with Manila by auxiliary service. Of the American, the Tampa Inter-Ocean Service Steamship Company, operating a monthly service, made its appearance. The Pacific Mail discontinued

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its Manila-East India Line as well as the direct line between San Francisco and Manila via Honolulu as it was found unprofitable. It must be pointed out, in this connection, that 1922 was a poor foreign trade year.

The Pan-Pacific Commercial Congress

It is interesting at this juncture to recall that in November last an international gathering of prominent men from countries bordering the Pacific Ocean met in what is called the Pan-Pacific Commercial Congress in that sunny and romantic city of Honolulu. Of the various propositions brought forward to promote the best interests of the region the most ponderous, and incidentally the most indicative of the unsettled shipping conditions on the Pacific, was that offered by an American. This shipping connoisseur proposed to divide the wide ocean into zones, these zones to be allocated to the different maritime nations in order to control the size of tonnage in relation to the requirements of the trade in the respective zones and thus effect the elimination of unnecessary bottoms which increase operating and maintenance expenses and become a burden on commerce and trade. It appears to the writer that this fantastic proposition has served only to make the delegates overlook the fact that the biggest shipping question that can engage the minds of those interested in the Pacific trade is the proposed extension of the United States Coastwise Laws to the Philippines.

The Honolulu conclave which aimed at a rapprochment in amity, commerce and intellectual interest between the countries participating entirely missed the coastwise law question which is causing much dissatisfaction and speculation. The idea of internationalizing the trade and shipping situation in the Pacific, proceeding from the theory that trade is nationless and tribeless and thrives best where transportation is free and unshackled, will be blasted beyond identification. The Filipinos know of the anomalous fact that one can make shipments from San Francisco to Manila, for instance, more cheaply than he can from San Francisco to Honolulu despite the further distance of 4,000 miles to Manila. They know, of course, that by the operation of the coastwise law in Hawaii competition is eliminated, and its meaning is easily realizable.

Distance a Vital Element

The distance of the Philippines from the mainland of America is a vital element in the discussion of the wisdom or unwisdom of applying the law to that country. The Philippines is almost equidistant between America and Europe. Vessels originating from the Atlantic seaboard, with which the bulk of the trade is done, have longer voyages to make than those coming from European ports. The difference in ocean distance between the Panama Canal route and the Suez is only around 100 miles to the port of New York. When the freight is increased the tariff advantage which America and the Philippines enjoy from each other will be wiped off and the exports of America to that country will be subject to unnecessary ruinous competition from European and Oriental exports. This, of course, means the diversion of trade from America to Europe, a consummation stoutly to be prevented.

The only remedial measure is to raise the tariff wall around the Philippines (that country has a different tariff law than the United States). This might be desirable were it not that the result would be the raising of the cost of living in that country. This is one of the strongest reasons why the Filipino people are dead against the extension of the coastwise law to their country.

Manufacturers in the United States are opposed to the plan because the increased cost of transporting merchandise will either have to be absorbed by them or passed on to the ultimate consumers in the Philippines. Being unprepared to do the former they see that by making the consumers pay will only result in the diminution of the demand and therefore a distinct loss to them.

Another thing that should interest American manufacturers who sell to the Philippines is that high freight rates will operate against Philippine exports and consequently impair the purchasing capacity of the country; while to those manufacturers who buy raw materials from the Philippines, advancing transportation and handling expense will place them at a big disadvantage in competition with manufacturers of similar products in foreign countries. To instance this assertion, high freight rates on copra, a tropical staple on the free list, will inevitably send it from the primary markets in the Far East to either Marseilles or Hull for crushing, and, also, the American cocoanut oil mills will be rendered idle. And shipments of oil from Europe to America will be resumed as in pre-war times. American oil crushers naturally are found to be in opposition to the law.

Effect on Manila

With regard to the effect of the law on the hope of making Manila a leading entrepôt in the Orient, opinions widely vary. The writer believes it will blast that hope completely. An American steamer leaving San Francisco, for instance, calls at Manila and then sails on to Batavia, Java. The same itinerary is followed on the return voyage. She can carry cargo between the three mentioned ports without contravening any law. On the other hand, a Dutch liner from San Francisco cannot carry cargo or passengers from that port to Manila and it would not be worth its while to make a detour to the latter port to pick up whatever business it could get for Batavia. The resultant condition would be virtually to confine the bulk of shipping between Manila and Far Eastern ports to American bottoms. There should really be no objection to that scheme were it not so inimical to trade in placing the Philippines on a non-competitive basis. The geographical position of the country in relation to America and the highly competitive nature of its products will affect very adversely its economic existence if it were to be placed out of joint in the scheme of commerce in the Far East by restrained transportation facilities.

From this point the discussion can go to the claim that by the American ships giving the "stoppage in transit" and "fabrication in transit" privileges to shipments out of Manila to surrounding ports the talk of making Manila the distributing point for American manufactured goods will be nearer to realization. The writer sharply differs from this view. Upon the precedent of comparative freight rate to Hawaii, it is not improbable that the rate from America to Manila would be higher than to, say, Batavia, Sourebaja, Saigon or Singapore, the difference in distance not being over 2,000 miles and the long haul making the steaming distance comparatively shorter. Besides, it is reasonable to expect that shipments from America to foreign ports in the Orient will be made in foreign flag steamers who can quote lower rates.

Certain maritime laws are simply constricting the life of the American merchant marine, which deserves to exist and exist in a fashion that is befitting the world importance of America. The coastwise law proposition as regards its extension to the Philippines which is separated from the mainland of America by the widest ocean in the world will tend to destroy the Philippine-American commerce and ultimately redound to the damage of the merchant marine itself.

For Conversion to Motorships.—Sidney Henry, Director of Sales, United States Shipping Board Emergency Fleet Corporation, announces that the steel tankers *Bidwell* and *Miller County* of 10,254 deadweight tons each, and the steel cargo *Challenger* of 11,850 deadweight tons, have been sold to the Sun Shipbuilding Company, Chester, Pa., for conversion to motorships.

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Recent Developments in Marine Insurance

Discouraging Outlook — Over-Insurance — "Sister Ship" Salvage—War Rates—Towing—Barge Canal—"Collision"

By "Bordereaux"

MARINE underwriters are considerably discouraged by the failure of the passage of the Ship Subsidy Bill, particularly as it comes at a time when many other factors are conspiring to restrict a prospect of profit in their business. They fear that the collapse of the subsidy campaign presages a lack of interest in our maritime affairs and may mark a declension of our merchant marine to a point of unimportance comparable to that of pre-war days. If it is true that insurance follows the flag, then the loss of our merchant marine holds out little hope for American underwriters, particularly as they are in daily active competition with a nation whose maritime affairs are its chief consideration and where the Government and the various branches of industry stand firmly behind all measures for the advancement of overseas trade.

With the conclusion of the first quarter of 1923 opportunity presents itself to permit of underwriters making a reasonably accurate survey of the outlook for the year. It is the judgment of the Street that 1923 will not result as satisfactorily as did its predecessor, comparing the actual underwriting outcome of each year. The principal reason for this anticipation is the forced lowering of rates to a point, in many instances, far below those of the pre-war period. One class of commodities after another has been subjected to savage rate attacks, under spur of hungry competition, until it is impossible to name a single important class of merchandise or hulls which has escaped the raiding tactics. Premium at any price appears to be the slogan, even in what have always been regarded as conservative offices. It is a problem how long the situation can endure.

Still another influence that has a conflicting effect on the marine insurance business for 1923 is the increasing prosperity of the country. Strange as it may seem, marine insurance is both benefited and injured by a wave of prosperity at home. It is benefited in that when wages are high everyone has money to spend and there is a demand for commodities which greatly increase our import trade, thus augmenting premium writings on important business from abroad. And the insured values are higher, with a corresponding increase in premium volume, because prosperity generally means an advance in prices. But, unfortunately, there is often a reflex action in a rising tide of prosperity, in that an increase in wages and commodity prices at home makes it more difficult for the American exporter to compete in foreign markets for the world's trade. Just now, in many lines, our exporters are finding increased difficulty in selling their products. This is notably true in the textile and other manufactured goods trade. If the English and German export markets were on a normal basis our export trade would feel this competition even more keenly than it does today. The only consolation that remains to the American underwriter is "the unexpected"; possibly relief may lie that way.

Over-Insurance

FROM time to time ill-formed parties break into print with protests against over-insurance of steamers by means of "honor" policies. This they pronounce a flagrant abuse of the system of P. P. I. coverage. These critics appear to be unaware of the fact that the underwriters have themselves adopted measures for the prevention of excessive sums being insured in respect of vessels by stipulating that the amount covered on disbursements shall not exceed 15 percent of the value of the steamer. Owners acting to the contrary are wasting both time and money, for if excessive insurance is taken out they would be unable to recover in event of loss.

"Sister Ship" Salvage

IN the past, difficulties have frequently arisen over the allowances which the Shipping Board has made to its own ships for salvage services rendered them. It is believed that trouble along this line will be obviated in the future through the good offices of a special committee that has just been appointed to act in an advisory capacity in this connection. The committee consists of George B. Ogden, chairman; Douglas F. Cox, William D. Winter, Hawley Chester and J. S. Gilbertson. Settlements arrived at by them will doubtless meet with general approval among underwriters insuring cargo in the vessels involved.

The regular Underwriters' committee recently attended a conference arranged with W. J. Love, of the Shipping Board, for the purpose of reviewing with the officials of that organization the arrangements for the handling of P. and I. claims. It found the Board most anxious to meet its proper cargo liabilities in a spirit of fairness and liberality. Mr. Love assured the committee that the Board stood ready to recognize all of its just liabilities and is prepared to provide machinery which will insure the prompt settlement of proper claims against it. The Board also expressed its readiness to confer with the committee representing the underwriters at all times for the purpose of adjusting any outstanding difficulties and smoothing the way for reciprocally satisfactory relations. When the subject of allowances came up Mr. Love showed a disposition to take a broad view of the matter and invited the formation of a committee to discuss with representatives of the Board the amounts to be allowed for "sister ship" salvage services, preliminary to the making of such awards. To this end the above-named committee was formed.

Barge Canal Hazards

AUTHORITATIVE estimates of the underwriting losses incurred on hulls and cargoes on the New York State Barge Canal last year fix the approximation in excess of $700,000. The premiums scarcely passed $200,000. In the light of such a disastrous experience the natural inclination of the underwriters is to abandon barge canal coverage altogether; and this they have determined to do unless the State will introduce substantial improvements for the safeguarding of floating property on that important waterway. And what the underwriters quote in the way of rates is something of prime importance, since it represents an overhead charge that will determine shippers to abandon the canal in favor of rail transportation. A co-operative movement is now under way, in which underwriters and transportation men have joined issues, and they have submitted, through a joint committee, a series of recommendations which Superintendent of Public Works Walsh proposes to make use of in an attempt to secure from the New York Legislature funds for

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effecting the improvements indicated. The insurance men on this joint committee are Howard W. Beebe, chairman; Edgar E. Lethbridge and George C. Owens; and the transportation men are G. Roy Hall, of the Inter-Waterways Line; S. MacClinkan, of the Trans-Marine Corporation; and S. W. Bullock, of the Inland Marine Corporation.

Among the more pressing improvements recommended by this committee are the building of a new breakwater off the Eastern entrance of Oneida Lake to protect shipping against the northwest winds, the buoying of the North and Middle channels of the lake, and the installation of a system of storm signals at each end of the lake. It is a singular fact that whereas the rapid rises in the Mohawk River caused most of the losses in 1921, in 1922 the scene of disasters shifted almost entirely to Oneida Lake.

War Rates Reduced

WITH France making steadily increasing incursions into German territory the question of a possible war between those nations is frequently under consideration by underwriters, but the matter is not as yet in a position to cause serious anxiety. It is difficult to arrange an equitable basis for determining war rates because, as a matter of fact, there is no war, and any violation of the Versailles Treaty on the part of France is a different thing from an act of war. England, being nearer than we are to the seat of these troubles, is in position to act with the greater intentness and accuracy; and the Britishers are evidently complaisant as respects war possibilities. To this end their underwriters have recently made a substantial reduction in war rates, as follows: German steamers outward bound from German ports, 5 shillings; homeward bound, 7 shillings and 6 pence. Steamers of other nationalities, outward and homeward, 6 pence. These rates will have their effect in the American market, with the added consideration of how the delicate balance of scowling nations at peace may be adjusted to warlike activities.

Responsibility in Towing

BY a recent court decision a ship that undertakes a tow is held responsible if she abandons her tow in order to save herself and the towed vessel is later lost because of the exhausted condition of her officers and crew occasioned by their efforts while in tow. Under such conditions, also, the negligence of the towing vessel cannot be charged to her charterers, where the charter was not a demise, 284 Fed. Rep., 56. In this instance in court the Norwegian bark *Aggi* was undertaken to be towed by the steamship *Edgar H. Vance,* then under charter to W. R. Grace & Company, from San Francisco to Balboa, Isthmus of Panama. Action was brought by the underwriters on the lost *Aggi.* In view of the terrific storm that was raging when the tow began, and in the light of the evidence as to disregard of weather probabilities on the part of the master of the towing vessel, the latter was adjudged guilty of maritime negligence and his vessel was held responsible for the damage caused by the *Aggi's* stranding after she was abandoned by the *Vance.*

New P. & I. Agency

ON February 20 the new United States Protective and Indemnity Association went into active operation, with more than 100 agents on duty at the more important ports throughout the world. These agents have authority to settle claims up to a maximum of $1,000; larger claims will be taken up by the home office. This is an offshoot of the United States Shipping Board, but it will do business with private owners as well. Its president is Nathan A. Smyth; vice president, in charge of domestic work, Capt. I. L. Evans, director of the Sea Service Bureau and an expert in admiralty law; Capt. F. E. Ferris, formerly Shipping Board Commissioner at London, in charge of foreign activities; John Nichol, formerly of the Old Dominion Line, head of the cargo department; Oliver C. Garvin, of the claims department of the Barber Line, in charge of personal injury; and F. D. Yott, former legal adviser to the American Red Cross in Europe, legal adviser for the foreign department.

The organization will handle business of a liability nature that is not usually covered under the straight marine policy, the Protection and Indemnity Clauses being introduced, when desired, to effect this protection. In cases where owners desire to have all their liability covered under a single policy, it is advantageous to have this feature taken care of in the special clause.

It was formerly the custom for underwriters to assume under the Collision Clause only three-quarters of the collision liability and to assume none whatever for loss of life or personal injury or for damage to harbors, docks, piers, nor for damage to goods on board the vessel, nor for any other liability for which the owner might be held by law. The theory behind this action was that leaving one-quarter of the collision liability with the owner would have the effect of making him more diligent in seeing that his vessel was carefully navigated. Thereupon there arose clubs that undertook the insurance of these factors, and the result was that all the supposed advantages of leaving these risks partly on the shoulders of the owners were lost to the underwriters. Accordingly the three-quarters limitation has come to be usually omitted from the Collision Clause.

Court Definition of "Collision"

AFTER litigation extending over nearly three years, in which one case was carried from the lowest courts to the highest in the State of New York, the Carroll Towing Company, Inc., has won out over the Ætna Insurance Company, and the word "collision" has received an authoritative definition, 196 N. Y. Supp. 698. Instead of meaning fortuitous contact between two vessels or other navigable objects, the court holds that "collision" means contact with or impact upon foreign bodies present in the water and is not restricted to mere collision with navigable objects.

Numerous court decisions were cited in support of this stand. One was the finding of Chief Judge Parker, 163 N. Y. 114; 57 N. E. 302, which was expressed as follows: "Collision, in its strict nautical and legal acceptance, originally meant the impinging upon one another of vessels while being navigated, but in course of time and by common usage the application of the term has been so far extended, in this country at least, as to include the impact of a vessel with other floating objects."

Judge Hough, in Western Transit Co. vs. Brown (D. C.) 152 Fed. 476, said: "Neither is it denied that the word 'collision,' as used in marine insurance, can no longer be limited to that fortuitous contact of navigating vessels which is its obvious and natural signification."

SHIP SALES.—Eight steel tankers have recently been sold by the United States Shipping Board Emergency Fleet Corporation to the following companies: The *Hammac* of 9,980 deadweight tons to the General Petroleum Company, New York; the *Halo* of 10,078 deadweight tons to the City Service Company, New York; the *Tustem* and *Bohemian Club,* of 9,799 deadweight tons each, to the Atlantic Refining Company, Philadelphia, Pa.; the *Devolente* and *Richconcal,* of 10,000 deadweight tons each, to the Beacon Oil Company, New York, and the *Warwick* of 6,008 deadweight tons and the *Deroche* of 10,000 tons to the Union Oil Company.

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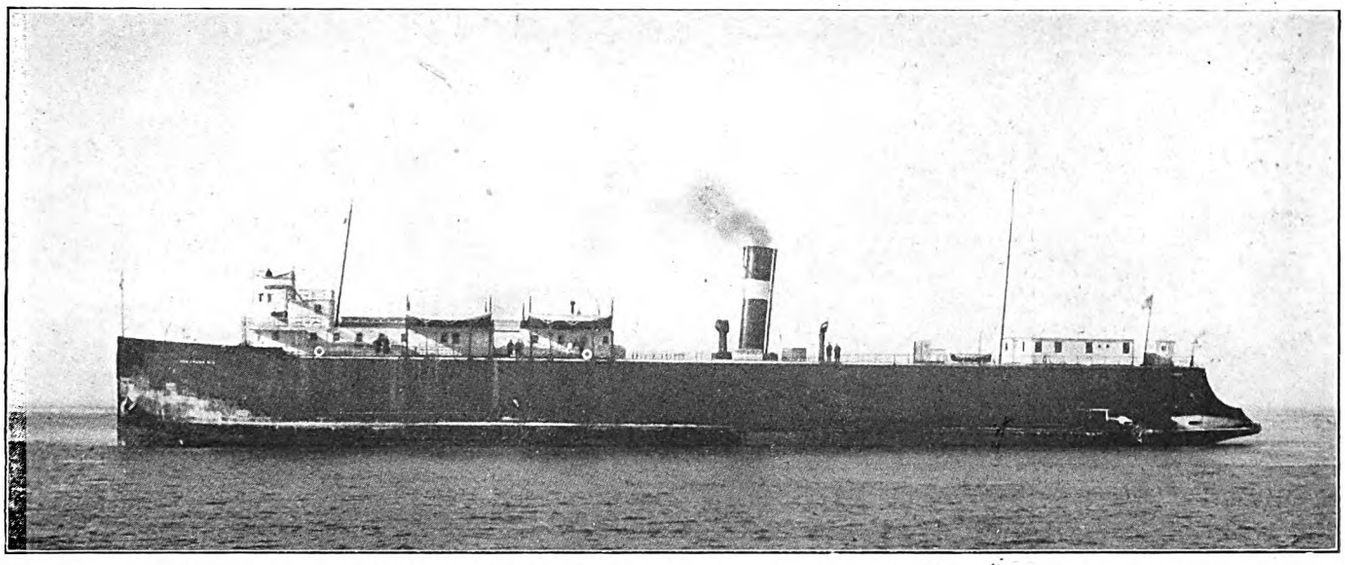
Ann Arbor Car Ferry No. 3 Lengthened to Give 33 Percent Greater Car Carrying Capacity

THE Ann Arbor Railroad Company initiated the first lake car ferry movement known to transportation where sea operation was undertaken. The idea was conceived by them in 1890, and at that time they constructed two wooden car ferries, Nos. 1 and 2, which were placed in commission in November and December, 1892. These vessels had a carrying capacity of approximately 24 freight cars, the cars being generally about 30 feet in length. The first steel car ferry, now known as the No. 3, was constructed and placed in operation in 1898, and in 1906 the No. 4 was put into service, the two wooden car ferries then being retired. In 1910 ferry No. 5 was built, and during 1917 ferry No. 6 was placed in commission. These vessels are so constructed and powered as to be able to navigate without difficulty during the winter as well as the summer months.



Lengthened Car Ferry No. 3 of the Ann Arbor Railroad

While the Ann Arbor Railroad Company established the first car ferry system on Lake Michigan in 1892, other railroads have since followed with service on several of the Great Lakes. Other points where long car ferry systems are now operated are on the Trans-Siberian, between Germany and Sweden, and by the Flagler system between Key West and Havana.

Ann Arbor car ferry No. 3, operating between Frankfort, Michigan, and Manitowoc, Wisconsin, recently left the plant of the Manitowoc Shipbuilding Corporation, where the vessel received extensive alterations. The ship was placed in a floating dry dock, cut in two, and lengthened 48 feet, giving it an increase in car carrying capacity of about 33 percent. The keel length of the vessel is now 307 feet. New quarters for the crew were fitted on the upper deck in a new deck house, and increased passenger carrying capacity was provided.

New Propelling Machinery Installed

During the lengthening operation, the old propelling machinery, consisting of two horizontal compound engines, and two natural draft Scotch boilers, were removed, and an entire new installation of modern propelling machinery was made. This consists of two triple expansion engines and two Scotch boilers 13 feet in diameter and 11 feet 6 inches long, carrying 180 pounds' steam pressure and operating under forced draft. The engines are of the vertical, three-cylinder, direct-acting type, each developing 700 horsepower at 110 revolutions per minute and directly connected to outboard turning, four-bladed, solid cast steel propellers of sufficient weight to stand up under the severe ice conditions of winter service. As is usual on Great Lakes service, jet condensers are employed. The vessel is fitted with a very complete equipment of modern pumps, including ballast, feed, general service, sanitary and fresh water, and is lighted throughout by electricity supplied by two 10-kilowatt engine driven generating sets.

On her first trip after lengthening, the Ann Arbor No. 3 made the trip from Manitowoc to Frankfort, with 26 cars aboard, at a speed exceeding 13 miles per hour.

(Photograph by Kadel and Herbert, N. Y.)

Men of the United States Lighthouse Service Adjusting and Re-fueling a Buoy in Heavy Seas

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S. S. Elisabethville: Interior Views of First Class Accommodations. (1) Hospital. (2) Writing Room. (3) and (4) Music Room. (5) Dining Room. (6) Smoking Room.

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New Belgian Mail Ships for Service to Africa

Combined Passenger and Cargo Steamships Built to Relieve Heavy Traffic Demands to Belgian Colonies

THE combined passenger and cargo ships *Elisabethville* and *Thysville* put in commission a few months ago by the Compagnie Belge Maritime du Congo Mail-Boats were built and engined at Seraing, Belgium, by the Société Anonyme John Cockerill, to replace ships torpedoed off the French coast during the war. The increasing traffic demands between Belgium and her colonies in South Africa and along the Congo made necessary the addition of these two ships to relieve the other vessels of the Compagnie Belge Maritime du Congo Mail-Boats.

The principal dimensions of the steamship *Elisabethville* are:

Length between perpendiculars	440	feet
Breadth, molded	56	feet 10 inches
Depth, molded to shelter deck	37	feet
Draft	25	feet 3 inches
Gross tonnage	8,178	
Displacement at load draft	13,250	
Service speed	16	knots
Accommodations:		
First class passengers	180	
Second class passengers	134	
Officers	20	
Crew	192	
Total	526	

The vessel is of the shelter deck type for carrying passengers and cargo and is classed 100 A-1 at Lloyd's under special survey. The watertight sub-divisions in the hull comply with the International Convention Regulations on Safety of Life at Sea. The ship has five decks. The watertight bulkheads are carried to the shelter deck and are fitted with doors operated both by hand and by the Stone-Lloyd hydraulic system. This system can be operated at the doors on either side of the bulkhead and from the navigating bridge.

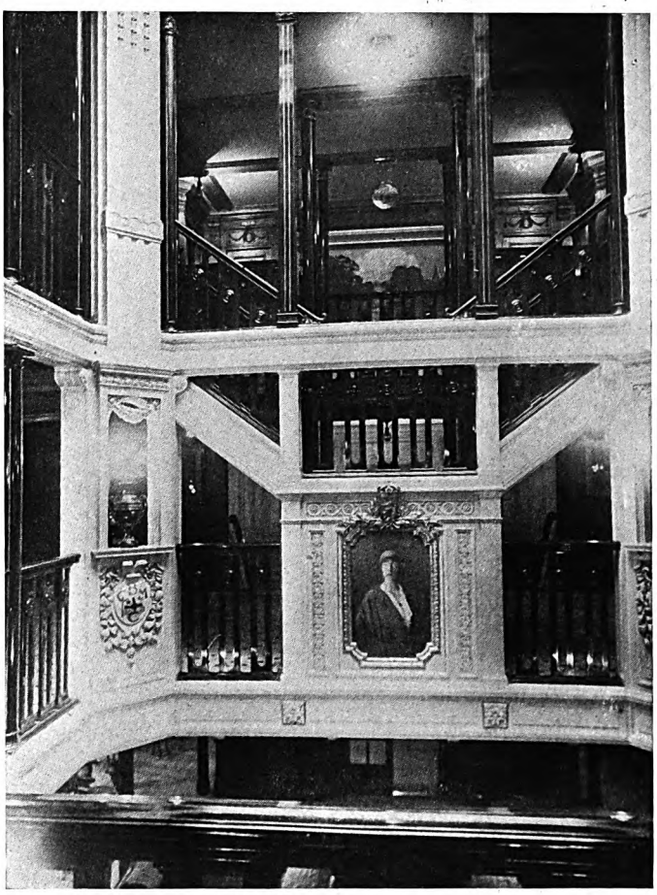
The lifeboat capacity provides for every individual that will be carried. Welin davit equipment is supplied for all lifeboats.

Passenger Accommodations

Cabins for first class passengers are located on the bridge and shelter decks while the upper deck is devoted to second class passengers. The first class dining saloon is situated on the shelter deck forward of the engine and boiler casings and is reached by a double staircase from the first class lounge. Seating accommodations for 200 persons are provided. The second class dining saloon is situated on the same deck aft of the engine and boiler casings and has accommodations for 140 passengers. Other public rooms include first class lounge, first class smoking room, ladies' lounge and second class smoking room.

The first class lounge is in the shape of a large circular gallery lighted from above by a trunk, the ceiling of which is in the form of a stained glass dome embodying in design the signs of the Zodiac. Wainscotting panels and window frames are of polished oak, the curtain material used being mauve and gold silk. The uniformity of the panels is relieved by curved columns on which vases matching the urn-shaped light bearers at the four corners of the trunk are placed. The lounge is furnished with russet upholstered seats and chairs. In the space intended for the orchestra an allegorical oil painting forms an attractive background while against the surrounding panels sculptured panoplies of musical instruments are placed.

Leading from the lounge is the ladies' saloon ornamented in the Louis XVI period. The panels in this saloon are of citron wood alternated with polished mahogany stanchions. Oil painted medallions framed with carved mahogany copied from masterpieces in the Brussels and Antwerp galleries adorn the walls. Window curtains and hangings are in gold and blue silk trimmed with design to match the upholstery of seats and chairs which are trimmed with blue corded velvet.



Well Over Dining Saloon

A double stairway leads to the first class restaurant which is treated in white, the panels being relieved with decorated moldings. The furniture in the restaurant is upholstered in royal blue Utrecht velvet. The windows are decorated with cream moire and especially in the tropics a much appreciated effect of coolness is obtained.

The first class smoking room, situated on the bridge deck aft of the engine room is reached by a double flight staircase adorned with a stained glass window depicting the "Crocodile river" at Boma. The decoration of this space is of modernized Flemish style and the windows are framed with polychrome tiling. The center panel depicts the Halles of Ypres in a sepia tint while the others represent other Flemish landscapes. The furniture has antique leather coverings and the general effect is one of quiet and comfort.

Above the lounge is a series of staterooms with bathrooms adjoining. In these staterooms the furniture is of the Louis

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S. S. Elisabethville: Interior Views. (1) Cabin de Luxe. (2) Captain's Cabin. (3) Wireless Room. (4) Galley. (5) Print Shop. (6) Hair Dresser's Shop.

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XVI period of polished mahogany and matches the richly tinted carved panels and ceilings.

The same effect of luxury and comfort is carried out through the second class accommodations.

Throughout the entire ship the side lights and windows are fitted with mahogany blinds which are very essential while in the tropics for the same reason that those of the officers' quarters are fitted with mosquito proof copper wire gauze.

All of the woodwork and furniture was produced in the work shops at the shipyard.

Propelling Machinery

As noted the ships were engined by the Société Anonyme John Cockerill. The main propelling machinery consists of two sets of quadruple expansion engines developing 7,300 indicated horsepower which will give a normal speed of about 16 knots. The twin screws are of the built-up type each with three manganese bronze blades secured to the propeller bosses by Martin steel studs and gunmetal cap nuts. The bosses are of cast steel with cast iron cones fitted over the propeller nuts. All the main shafting is made of hydraulic forged ingot steel.

The ships are fitted with six Scotch single ended boilers working under a pressure of 215 pounds per square inch having a total heating surface of 14,100 square feet. These boilers were built by the Seraing Works of Cockerill and are arranged to work under Howden's forced draft system with two steam-driven fans.

Auxiliary Machinery

The auxiliary machinery of the vessel includes the following:

Two circulating pumps of the centrifugal type, driven by compound engines, for circulating the water through the main condensers.
One auxiliary centrifugal circulating pump for the auxiliary contraflo steam condenser.
The feed pumps comprise two main double acting Weir pumps and one auxiliary double acting pump.
The evaporating plant consists of one Morison's radial evaporator with a capacity of 35 tons per 24 hours.
One general service pump of the vertical duplex type, which can be used for bilge suction, sanitary, feeding or circulating service.
One sanitary pump of the vertical duplex type.
One ballast pump of the vertical duplex type.
One fresh water pump of the vertical duplex type for washing and drinking purposes.
One distiller, Quiggin's Patent, with a capacity of 150 gallons per hour.
One underline hydraulic ash expeller of the Stone system.

The refrigerating plant consists of:

Two simplex vertical machines of Hall's type with a capacity of 4 tons of ice per 24 hours.
One CO_2 duplex evaporator.
Two independent brine pumps.
Two circulating pumps for the CO_2 condenser.
Total capacity of refrigeration chambers, 13,000 cubic feet.

Electric Plant

Each vessel is equipped with three sets of 30-kilowatt dynamos driven by compound engines. An emergency unit, consisting of a 10-kilowatt dynamo driven by a Parsons type motor is installed.

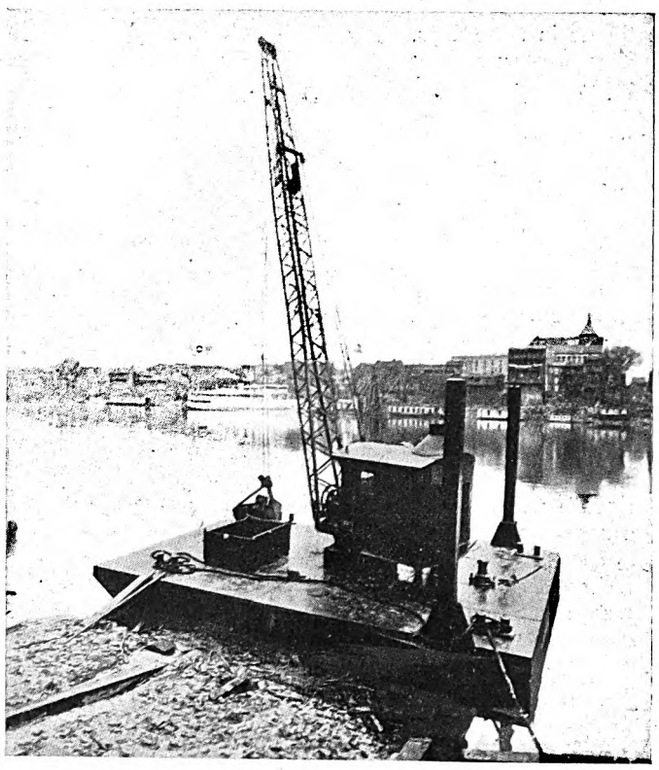
The wireless equipment consists of two independent sets, one a quenched spark set having 1½ kilowatts capacity and the second a continuous wave set having 1½ kilowatts capacity. The maximum effective range of each set is 2,500 miles. The type of continuous wave set employed is particularly adapted to ship work because of its rugged construction, simplicity and rapidity of operation. Power for this transmitter is supplied by a motor generator on the upper deck and controlled from the wireless cabin. An emergency transmitter is also installed, current being supplied from an independent accumulator battery of ¼ kilowatt capacity. This set has a main range of 220 miles.

The latest type Marconi direction finder is also installed. This instrument is used for taking bearings at a distance of 400 to 500 miles.

Derrick Barge Designed for Excavation Work

A GENERAL service derrick barge, designed for the Kelly Axe Manufacturing Company, Charleston, S. C., by Cox and Stevens, naval architects, New York, has recently been constructed by the Charles Ward Engineering Works, Charleston, W. Va.

The barge is primarily intended for excavating a lagoon at the company's works to form a harbor for the floating equipment owned by the organization. Later the barge is to



Derrick Barge Equipped with Steam Locomotive Crane

be used for loading and unloading steel material, for handling hickory logs obtained on the Tennessee, Cumberland and Green rivers and also for unloading barges at various points on these rivers where the finished products are delivered.

The length of the hull is 42 feet, the breadth 30 feet and the depth 5 feet. The draft when fully loaded is only 34 inches. The hull is of steel construction throughout, one end having a rake aft to facilitate towing. The opposite end of the hull is square and here two anchorage spuds have been placed.

The barge is equipped with one No. 4 type "H" Brown Hoist Company's steam locomotive crane with a structural base. The maximum reach of the crane boom, when in its lowest position, is 38 feet beyond the end of the hull. It has a capacity at 19 feet 6 inches radius of 22,250 pounds and at 57 feet radius of 5,200 pounds. The hull in the way of the foundation for this crane was made into a watertight

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compartment to provide a fresh water tank for boiler feed water. On deck a portable coal box is provided having a capacity of 3 tons. When the fuel is to be replenished the coal box is swung ashore by the crane, filled and returned to its place on the deck.

Scout Cruiser Omaha Goes Into Commission

THE new scout cruiser, *Omaha,* the first of ten sister ships being built for the United States Navy, successfully completed her official trial on Puget Sound, and on February 24 was put into commission at the Bremerton Navy Yard.

As the highest powered vessel ever to sail under the American flag, this ship, with only one-half of the boilers in use, and these at only two-thirds of their capacity, went through the water at a speed that would take her across the Atlantic in less than four days. With all of the boilers in use a speed will be developed which would enable the vessel to cross the Atlantic in three days.

For two hours, as directed by the Naval Board of Inspection and Survey, headed by Captain Decker, runs were made over a measured mile course at 26½ knots, and then for four hours a straight course was held from Tacoma to Port Townsend and back at a speed in excess of 27 knots, reaching 27½ knots, or in excess of 31 miles per hour, for some of the time.

The ship was manned by a crew from the Todd Dry Dock and Construction Corporation, builders of this cruiser, and of two sister ships, the *Milwaukee* and *Cincinnati,* which will shortly follow her from the yard. No attempt was made to obtain the highest speed possible even with only half of her boilers in use, and in fact it was only required that a speed of 25 knots be maintained for the six hours.

The absence of vibration and motion usually associated with traveling on the water at 30 miles an hour was particularly noticeable. When at lunch, out of sight of the water, it was difficult to tell whether one were afloat or in a room ashore, except that there was no rumbling and shaking from passing trucks and trolleys.

After the completion of the trials the *Omaha* proceeded to Bremerton where Captain David S. Hanrahan, a noted destroyer skipper, took command with Lieutenant Commander H. T. Smith, who had spent some time at the builder's yard during construction, in charge of the engine rooms. A crew picked from the destroyer force came aboard and will be trained to operate the machinery and handle the ship in service.

In addition to the trial board, Captain Hanrahan, Lieutenant Commander Smith and other officers who will form part of the personnel, representatives of the builders of the ship, and of the machinery were aboard during the trial, and all expressed satisfaction with the performance and appearance of all portions of the work.

Designed for a speed of over 33 knots, the *Omaha* was built at Tacoma, Washington, by the Todd Dry Dock and Construction Corporation. There are 12 watertube boilers constructed by the Union Iron Works at San Francisco, equipped with Babcox and Wilcox fuel oil burners, each boiler capable of producing 125,000 pounds of steam an hour. This means that each hour all twelve boilers can turn 700 tons of water into steam, or more water than could be carried by ten of the largest locomotive tenders.

Each of the four propellers is driven by a 25,000 horsepower cross compound Westinghouse turbine and reduction gear. When at full speed the turbines revolve at 2,500 revolutions a minute, and this speed is reduced by means of the flexible frame gears to 370 revolutions per minute of the propeller shaft. At 26.4 knots it was estimated that the propellers would revolve at 251 turns per minute; the actual trial came within less than one percent of this amount, showing the remarkable accuracy of the design.

The one hundred thousand horsepower installed for propelling this ship, besides being the greatest afloat under the American flag, makes this plant one of the most powerful for any purpose in the country. Few cities have power plants for lighting or operating the street railways of greater power.

A conception of the power of the *Omaha* is obtained by comparing it with our largest battleships with only one-third, and the mighty *Leviathan* with two-thirds the power installed in the *Omaha.*

It is not only important that these vessels be able to travel at express speed but they must be capable of going a great distance at the relatively slow speed of 10 to 15 knots. While the power needed at full speed will be 100,000 horsepower, at 12 knots it will only be 2,000, or 2 percent of the full power. In order to obtain a high efficiency at this small power cruising turbines are installed. These consist of small high speed turbines of the Westinghouse re-entry impulse type, with reduction gears which connect by means of a suitable clutch to the shafts of the main high pressure turbines.

By means of these cruising turbines it will be possible to operate the propelling machinery at 12 knots so efficiently that with a given expenditure of fuel the ship can steam over forty times as long, or fifteen times as far as at full speed.

Shipping Board Report on Foreign Commerce Issued

DIRECTOR R. T. Merrill of the Bureau of Research, United States Shipping Board, announces that the Bureau has completed its annual report of the waterborne foreign commerce of the United States, for the fiscal year, July 1, 1921, to June 30, 1922. This report shows the actual tonnage of cargo handled at the port, the amount and character of the principal commodities and their ports of destination, and origin. A previous report issued by the Bureau covered the cargoes entered and cleared at the principal ports of the United States, but did not show the ports of original loading or final discharge and therefore could not serve as a criterion of the actual port activities.

This report applies solely to trade between the United States and foreign countries, and is compiled primarily to aid the Shipping Board in its task of building up American flag services on essential trade routes. Because it does not include coastwise or intercoastal movements, it cannot be taken as a measure of the total activities of the individual ports. This is especially true of the ports having large coastwise movements and a small amount of foreign trade.

The growth of the intercoastal business, supplementing our already large coastwise trade, has been phenomenal and is especially noteworthy in the last six months. Were the figures of this movement included, there would be marked changes in the standing of many ports, particularly those of the Pacific coast.

Another feature of interest is the standing of certain ports due to one, or at the most two, predominating commodities. For example, it will doubtless be surprising to see Port Arthur, Texas, standing in the position it occupies. This rank is due wholly to its trade in petroleum, most of which, during the period shown, came from the Mexican fields. Later developments in oil production are tending to shift the center of production from the Mexican fields to southern California and, although a large part of its output will move to the East Coast by water, it is probable that a sufficient quantity will be exported from the Pacific fields to foreign countries to change markedly the standing of southern Californian ports in the next year.

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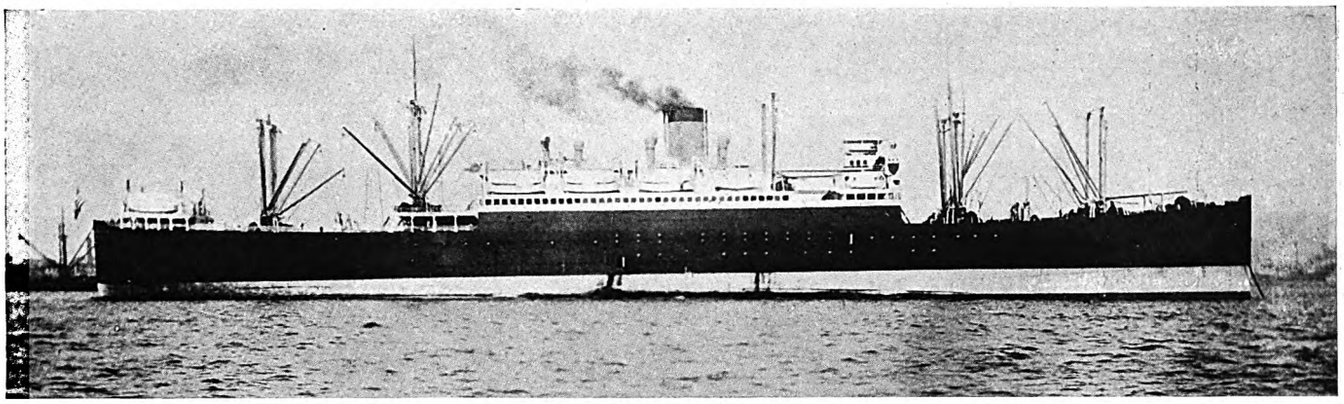


One of the Shipping Board's 535-Foot Passenger Steamships

Performance Standards Established by Shipping Board for 535-Foot Passenger and Hog Island Cargo Vessels

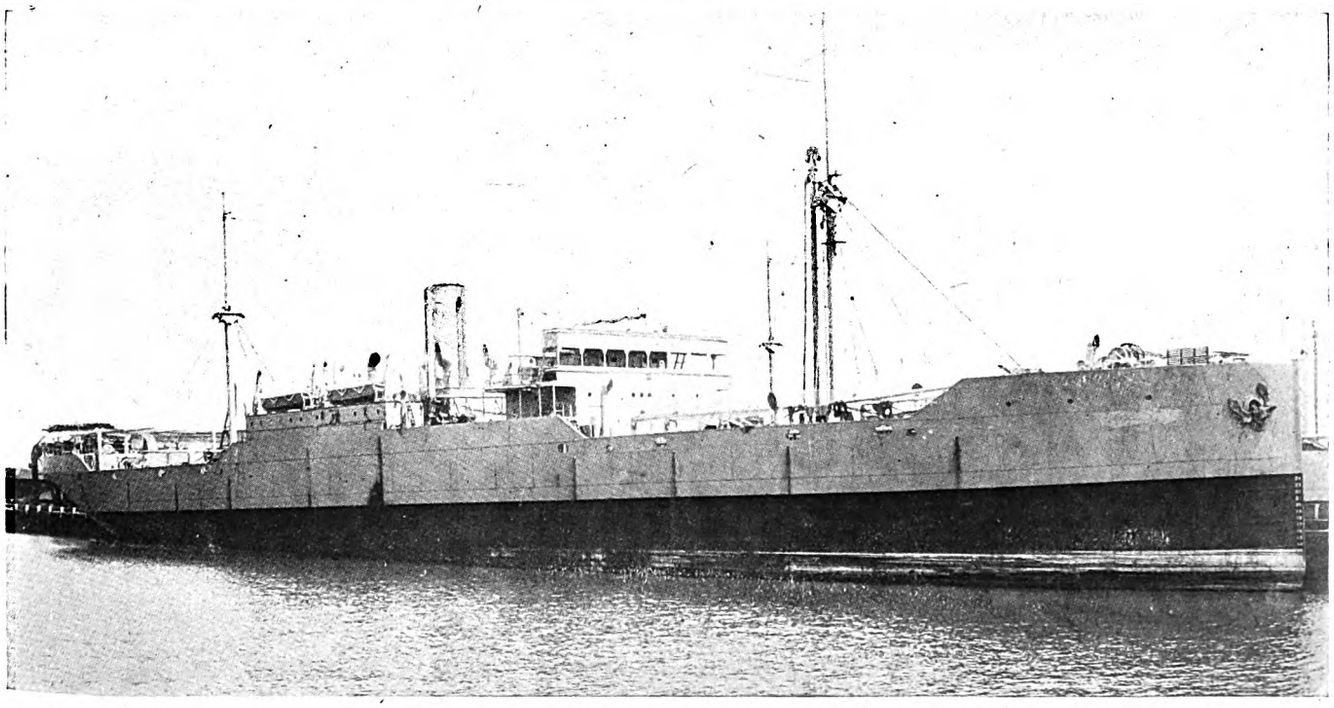
THE Fuel Conservation Committee appointed by Vice-President Joseph E. Sheedy of the United States Shipping Board, which consists of Captain C. A. McAllister, Captain R. D. Gatewood, (C.C.) U. S. N.; Colonel George Bartlett, E. H. Peabody, D. M. Myer, Major G. M. Talbot, Maurice Healey, F. B. Webster, and C. J. Jefferson, head of the Fuel Conservation Section, is continuing the work of establishing the standards of performance for the active vessels of the United States Shipping Board fleet. The methods employed in establishing these standards were outlined on page 783 of our December, 1922, issue, the first set of standards established being for the 502-foot ships.

The standards for the 535-foot passenger vessels and also for the large fleet of cargo vessels built by the American International Shipbuilding Corporation which are referred to generally as the Hog Island vessels have been completed and are being used by the various operators as a means of determining the efficiency of performance of the vessels of this class which they are operating.

535-Foot Passenger Vessels

The 535-foot passenger vessels have been subdivided into three classes and a set of performance curves developed for each class. These curves give the miles per ton of fuel which the vessel should make at a given draft and speed with moderate weather and average bottom conditions. They do not, however, represent impractical theoretical values but rather the values that have been obtained by several of the vessels of the class with the equipment and operating personnel working efficiently.

All of the 535-foot passenger vessels have the following characteristics:



Hog Island Type Cargo Steamship

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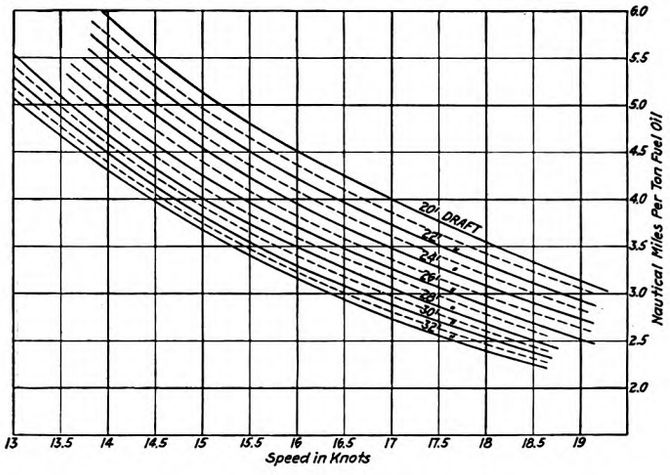


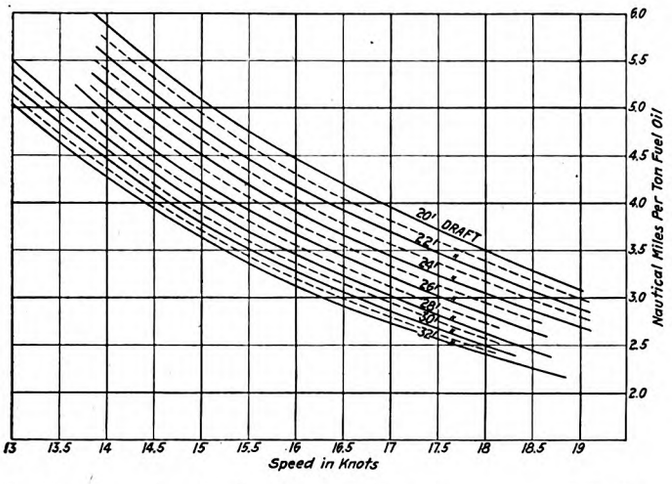
Performance Standardization, 535-Foot Passenger and Freight Steamships

S. S. President Taft, President Pierce, President Grant, President Cleveland, President Jackson, Pan America, Western World.

Length overall	535 feet
Breadth	72 feet
Depth	50 feet
Loaded draft	30 feet 7 inches
Deadweight tonnage	11,310
Speed, knots	17.5
Engines	2 cross compound turbines
Boilers	8 watertube or tubular

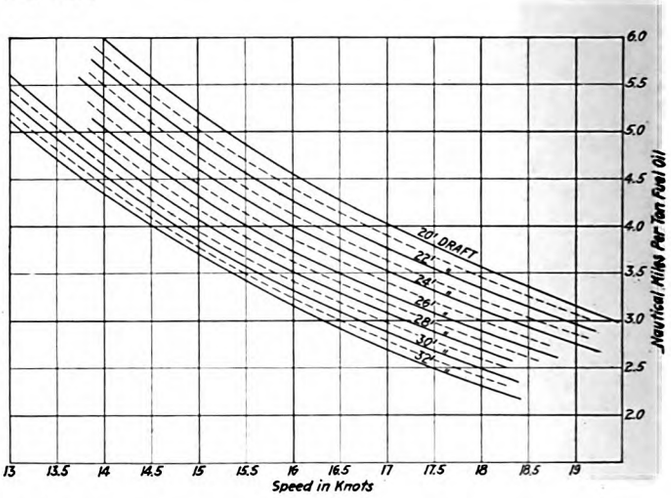
The first of these three classes consists of the steamships *President Taft, President Pierce, President Grant, Pan American, Western World, President Cleveland* and *President Jackson.* These vessels are all fitted with similar propellers. The first five were built by the Bethlehem Shipbuilding Corporation, and are equipped with Fore River turbines and Yarrow boilers. The last two were built by the Newport News Shipbuilding and Dry Dock Company, which also built the turbines for these two vessels. These have Babcock and Wilcox watertube boilers.

The second class consists of the steamships *President Harding, President Roosevelt, President Madison, President McKinley, President Wilson* and *President Lincoln.* They were built by the New York Shipbuilding Corporation and have similar propellers and are equipped with Fore River turbines and Babcock and Wilcox boilers.



Performance Standardization, 535-Foot Passenger and Freight Steamships

S. S. President Harding, President Roosevelt, President Madison, President McKinley, President Wilson and President Lincoln. Built by New York Shipbuilding Corporation and equipped with Curtis turbines.



Performance Standardization, 535-Foot Passenger and Freight Steamships

S. S. President Jefferson, Southern Cross and American Legion. Built by New York Shipbuilding Corporation and Equipped with Westinghouse turbines.

The third class consists of the steamships *President Jefferson, Southern Cross* and *American Legion.* These three were built by the New York Shipbuilding Corporation and are fitted with Westinghouse turbines and Babcock and Wilcox boilers.

From the tabulated performance of these vessels it was found that the efficiency of performance varies from 98.8 to 62.7 percent for the various vessels. Eight of the 16, however, showed over 90 percent efficiency and all except two, which on their earlier voyages were subjected to inefficient and poor operation, showed over 80 percent, the average for the entire class being 87 percent.

The general average performance for all the 535-foot passenger vessels, as shown by this tabulation, is as follows:

					Knots per ton		
Draft	R.P.M.	Observed speed, knots	Tons fuel per 24 hrs.	Pounds fuel per mile	A, Actual	B, Theoretical	A / B Correction Factor
24' 5⅛"	113.9	16.9	133	725	3.08	3.54	0.870

Hog Island Cargo Vessels

The standards for the Hog Island cargo vessels are of greater interest to the average operator as they are applied to the type of vessel which is the backbone of the merchant marine, for, after all, it is the cargo carrier which affects the greater part of our population, as this type of vessel carries the products of the Middle West, the products of the manufacturing centers and, in fact, the greater part of the whole country's foreign commerce. It is essential that these vessels be operated efficiently, if the American merchant marine is to be made possible.

The tabulation of the performance of these vessels shows efficiencies from 58.7 to 107.8 percent with an average of 83.67 percent for the entire class. The vessels of this class are practically identical and have the following characteristics:

Length between perpendiculars	390 feet
Breadth	54 feet
Depth	32 feet
Loaded draft	24 feet
Deadweight tonnage	7,840
Speed, knots	11
Engine	1 General Electric turbine
Boilers	3 Babcock and Wilcox watertube

Why should there be such a difference in the efficiency of performance? It has been found, as the individual cases have been taken up by the committee, that it generally hinges on the efficiency of the operating personnel and the attention which has been paid to the details of operation. In the one

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case, the vacuum system is tight and the vessel is developing full power with minimum fuel. In the other case, there are leaks in the system and the power falls down and the fuel consumption goes up. It is a problem of correcting details which must be met by the operating force and the attention which is paid to these details is reflected immediately in the efficiency of performance.

An example of this can be taken from the tabulation compiled by the committee. The worst performers immediately became problems for the committee to attack and it is gratifying to note that the worst performer has shown on a voyage completed since the standards have been put into effect an increase in efficiency of approximately 30 percent which gives this vessel a rating somewhat above the average of her class.

The general average performance of 70 Hog Island type cargo vessels, as tabulated by the committee, is as follows:

Draft	R.P.M.	Observed speed, knots	Tons fuel per 24 hrs.	Pounds fuel per mile	Knots per ton: Actual	Knots per ton: Theoretical	Percent efficiency
21′ 8 7/16″	80.6	10.33	29.14	26.33	8.51	10.17	83.67

The figures and curves cannot in themselves increase the efficiency of performance of the various vessels, but they do give the operators a definite target to shoot at and, in attempting to hit the standard, the increased efficiency and reduced fuel bill will be accomplished; in that way they serve their purpose and help to maintain an American merchant marine.

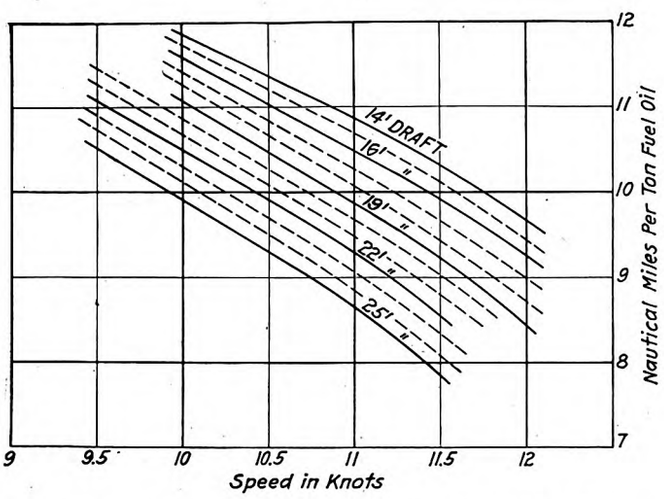
Instructions for Using Performance Standardization Curves

The curves on the performance charts show the number of nautical miles that a ship should travel on a ton of fuel for various speeds and drafts, and have been adopted as a standard for the ships as designated.

In arriving at this standard, due consideration was given for the increase in power required to drive the ship at sea over that required under trial trip conditions, and the increased steam consumption of the machinery at sea over that on tests. It is not expected that the ship will do as well on every voyage, as the curves show, as rough weather would decrease the mileage, yet in smooth seas the showing should be better, and the average performance should be equal to the standard, providing the ship and equipment are in proper condition, and properly operated.

The procedure for obtaining the performance of a ship on a voyage is as follows:

Divide the distance (in nautical miles) traveled by the fuel (in tons) consumed. This will give the actual nautical miles per ton of fuel.



Performance Standardization, Type "A" Steamships Built at Hog Island, and Equipped with Curtis Turbines

From the chart find the standard nautical miles per ton of fuel for the draft and speed on this voyage as follows:

On horizontal base line pick out average speed of voyage and run up this line in vertical direction until it intersects the curve corresponding to average mean draft, from this point follow over on horizontal line to read the miles per ton of fuel which represents standard performance.

Divide the actual performance by the standard and multiply by one hundred. This will give the percentage performance for the voyage.

Example: To find the percentage performance of a ship on a voyage.

For this we will take one of the 7,500 deadweight ton ships built by the American Shipbuilding Corporation, known as Hog Island type "A" ship.

Mean draft on leaving port	24 feet 0 inches
Mean draft on arriving	23 feet 0 inches
Mean draft on voyage	23 feet 6 inches
Distance traveled	3,000 nautical miles
Fuel consumed	310 tons
Speed	10.2 knots

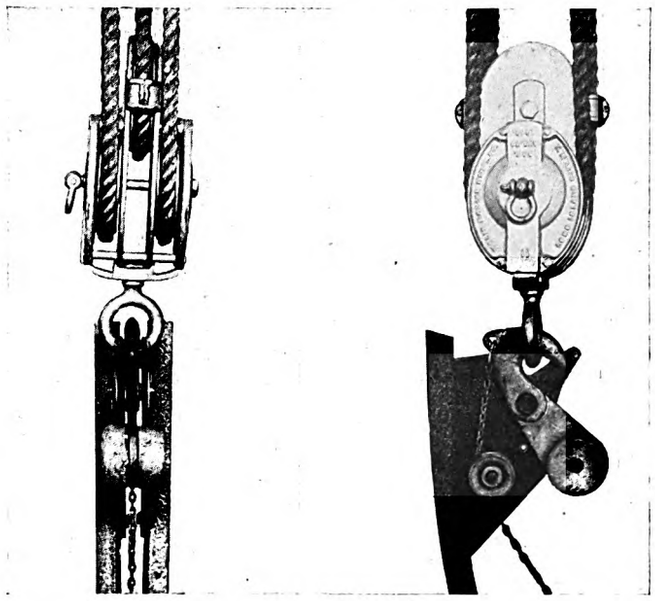
$$\text{Actual nautical miles per ton of fuel } \frac{3000}{310} = 9.68.$$

Standard nautical miles per ton of fuel for 10.2 knots and 23 feet 6 inches draft (from curves) = 9.95.

$$\text{Percentage performance} = \frac{9.68 \times 100}{9.95} = 97 \text{ percent.}$$

Improvements Made in Welin Marine Type Mills Releasing Gear

THE Welin marine department of American Balsa Company, Inc., Long Island City, N. Y., has recently succeeded in still further simplifying and making more reliable the Mills releasing gear, which has been on the market for twenty years. The number of parts has been reduced by so designing the supporting plate that it also acts as a guide for the eye of the block or shackle, thus making an end deck and guide casting unnecessary. In this new design all of the parts subjected to strain are made of wrought material and, as a result of this, the new design complies with the rules of the British Board of Trade as well as with the rules of the United States Steamboat Inspection Service.



End and Side Views of Gear in Locked Position

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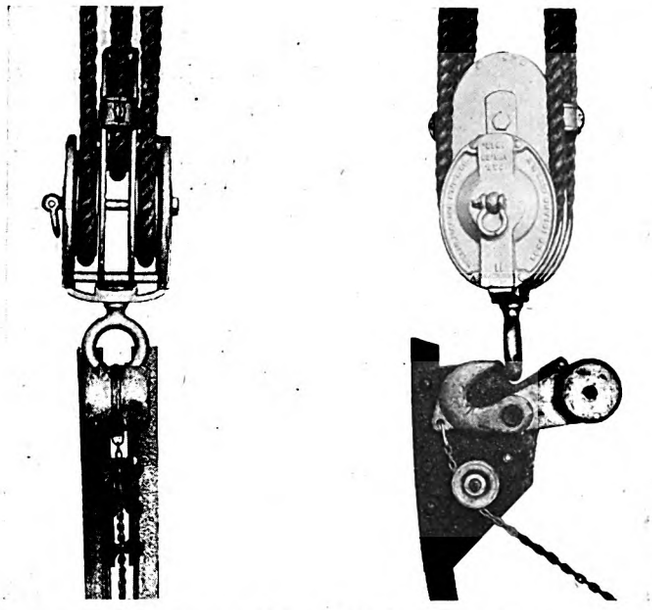

End and Side Views of Gear Unlocked for Release of Boat

These improvements in the Mills releasing gear have accomplished:

1. A gear with reduced number of parts and, because of this, of less cost to manufacture.
2. None of the parts subjected to strain is made of cast material.
3. A gear that is simple to install and easy to operate.
4. A gear with limit stops which make it positive of action.

This new type of gear is adaptable to installation in any type of lifeboat and, for the sake of safety, releases only when the boat is water-borne.

Vessel Tonnage Turned Out in Great Britain the Lowest in 30 Years

BRITISH ship production during the year 1922 represented a shrinkage of 50 percent since 1920, and made the poorest record for more than 30 years, says Commercial Attache W. S. Tower in a report to the Department of Commerce. The British merchant fleet is now only slightly larger than it was in 1914. About 98 percent of the increase in world tonnage since 1914 has been under flags other than British, and from controlling close to 45 percent of world merchant steam tonnage the British share has dropped to about 33 percent.

The course of ocean freights and time charter rates explains the reluctance to acquire more tonnage. The average ocean freight rate for 1922 declined 20 percent from the average for 1921, and the average of time charters showed a decline.

Prices for 7,000 to 9,000-ton ships, according to recent contracts, are said to range for £8 10s. to £9 10s. per deadweight ton, a drop of at least £2 per ton since July, £4 per ton since January, and close to £10 per ton in the last 18 months. The reduction has been made possible largely by drastic wage cuts and by lower prices for materials.

Vessels entering British ports with cargo during 1922 show a tonnage increase of 15 to 20 percent over 1921. For clearances with cargo the showing is far better, the average monthly tonnage in the last quarter of the year being almost 40 percent larger than for the corresponding period of 1921.

This increase of activity was promptly reflected in a decrease of idle tonnage in British ports. The decrease from quarter to quarter since July 25, 1921, is shown in the accompanying table.

Tonnage of Vessels Laid Up in British Ports

Date	British Flag No.	British Flag Net tons	Foreign Flag No.	Foreign Flag Net tons	Total No.	Total Net tons
July 25, 1921.....	883	1,650,788	140	201,624	1,023	1,852,412
October 25, 1921.....	654	1,158,425	88	137,811	742	1,296,236
January 1, 1922.....	621	1,179,548	91	128,045	812	1,307,593
April 1, 1922.....	422	734,240	62	102,379	484	836,619
July 1, 1922.....	533	1,025,662	50	86,670	583	1,112,332
October 1, 1922.....	419	752,469	37	72,155	456	824,624
January 1, 1923..... (Preliminary)	371	671,886	40	60,312	411	732,198

Propelling Machinery of the New White Star Liner Doric

MUCH interest is being manifested in steamship engineering circles over the engine equipment of the new *Doric*, which is now completing at the Harland and Wolf yards at Belfast to enter the service of the White Star Dominion Line between Montreal and Liverpool. The *Doric* is scheduled to start her maiden voyage from Liverpool on May 11, and will sail on her return trip from Montreal May 26. She is a sister ship of the *Regina* and *Pittsburgh*, both completed in 1922, and like the other two was built particularly for the one cabin passenger trade. Her gross tonnage is 16,500, and length and breadth 600 feet and 68 feet respectively.

The *Doric's* main machinery consists of two sets of Brown-Curtis single reduction geared turbines driving one port and one starboard propeller. Each set comprises one high pressure turbine which exhausts to one low pressure turbine and thence to the condenser. The power is equivalent to about 4,500 horsepower for each, thus making a total for the ship of about 9,000 horsepower. An astern turbine is incorporated in the low pressure casing.

The ahead and astern control or maneuvering wheels are mounted on the high pressure turbine. It is interesting to note that all the bearings are worked under forced lubrication, and in the case of the gearing the oil is discharged through sprayers onto the teeth. Should the supply of oil fail through any cause, the steam from the boilers is immediately checked by the operation of a patent governor, which also shuts off in the case of excessive rotor speed.

The rotors of these turbines are each connected to its pinion by a flexible coupling, and the pinions mesh with the main gear wheels mounted on the main or propeller driving shafts. The rotors have speeds of about 1,640 revolutions per minute at the high pressure and 1,400 at the low pressure, which correspond respectively to peripheral speeds of 365 and 472 feet per second. As the propeller revolves at a speed of 100 revolutions per minute this gives a reduction from the high pressure turbines to propellers of about 16½ to 1. The main gear wheels, 12 feet in diameter, weigh about 36 tons each, and contain 671 teeth of 7/12-inch pitch cut in double helical style in order to neutralize end thrust.

The outside dimensions of the complete gearing are 11 feet by 14 feet by 15 feet, and the total weight amounts to 74 tons. The teeth of one gear wheel are cut at an angle of 30 degrees on a specially constructed machine, and the operation took altogether a full month to complete. To obtain a good face of tooth it was necessary to keep the machine running continuously day and night, as a stoppage might cause an imperfection in the cut of the wheel and thus affect its contact with the pinion.

Each of the vessel's low pressure turbines weighs about 40 tons. It is interesting to note that in the four turbines there are 35,500 phosphor bronze impulse blades, which, if placed end on end, would extend for a distance of three miles. The rotors are of forged steel, the casings of cast iron, and the plates for directing steam on to the moving blades are of nickel steel cast into an iron frame or diaphragm. Steam is supplied from the boilers at a pressure of 215 pounds per square inch.

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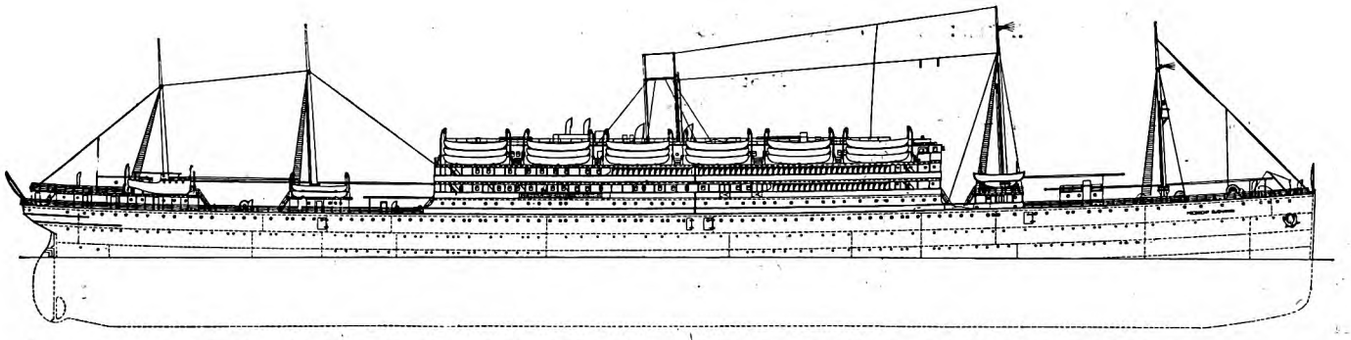

Outboard Profile of Steamship President Buchanan as She Will Look After Reconditioning

The Reconditioning of the President Buchanan

Unusually Complete Plans and Specifications Prepared to Convert Ex-German Liner Into One of the Largest of Cabin Class Vessels

THE *President Buchanan,* built in 1907 at the shipyards of Harland and Wolff, Belfast, is to be converted into one of the largest and best cabin ships afloat. The specifications and plans prepared by the Gibbs Brothers, New York, who performed the same task on the *Leviathan,* are so complete that little or nothing will be left to the imagination of the successful contractors. As will be seen from the illustrations, the drawings are of the working rather than the contract type, which means that a great saving will be made in the time that it will take to do the work.

The work on the *President Buchanan* is looked upon as the most extensive reconditioning job brought out so far this year. The bids on the work are expected to be opened on April 2 and it will then probably take from 128 to 180 days to complete the job. It will be noticed from the outboard profile that the appearance of the ship will be changed considerably as the bridge house has been elongated necessitating the removal of two masts.

The amount of money required to convert this steamship into a revenue paying vessel capable of carrying 2,141 passengers will probably be well over $1,000,000. Even a brief perusal of the principal changes to be made as outlined below will convince anyone of the magnitude of the undertaking.

Removal of Existing Accommodations

The whole of the existing joiner work, furniture, fittings and fixtures of the original first, second, third and fourth class passengers and of the officers and crew accommodations will be renewed. This includes all public rooms, staterooms, open berthing spaces, lavatory and toilet spaces, dining saloons and messrooms, galley and pantry compartments, hospital spaces, storerooms, etc. The ship's dry and wet provision storerooms, however, on *H* deck will be retained and reconditioned.

New accommodations for all cabin passengers will be constructed and equipped. They will be fitted out completely and extend from *A* to *G* decks. This will consist of about 200 two-, three- and four-berth rooms, a social hall and writing room, a ladies' saloon, a smoking room, a veranda, a gymnasium, a dining saloon seating 380 persons, lavatory and toilet spaces and bathrooms including 12 private baths, a galley, a pantry, two bakeries, a bread room, a butcher shop, deck stewards and service pantries with direct access to main pantry.

The existing main stairway from frames 114 to 118 will be replaced with a stairway of different type which will permit it to be fitted with fire-resisting inclosures on the several decks, and an additional main stairway will be constructed from frames 90 to 96 running from *G* to *A* decks and fitted within a watertight inclosure on *E* deck and fire-resisting inclosures on *A, B, C, D* and *F* decks. Fire screen bulkheads of approved construction will be fitted within this accommodation, their spacing not to exceed 130 feet. The engine and boiler casings passing through this accommodation will be efficiently insulated.

New Third Class Passenger Accommodations

The new accommodations for approximately 1,424 third class passengers will be constructed and fitted out completely in the space extending from *D* to *G* decks. They will consist of approximately 364 two, four and six berth rooms, 3 general rooms, 2 smoking rooms, a dining saloon in six sections having a seating capacity of 700 persons, combined lavatory and toilet spaces, bathrooms and washrooms, laundries, a galley, a pantry, an auxiliary pantry, two hospital compartments with bathrooms attached, an operating room, a dispensary, two isolation hospitals with bathrooms attached, two disinfecting rooms, a canteen and linen office together with required stairs, ladders and companion hatches.

Officers' and Crews' Accommodations

New accommodations for about 350 officers and crew will be constructed and fitted out completely in the spaces from *A* to *G* decks. They will consist of staterooms for officers and petty officers, berthing space for crew, officers' messrooms, pantry, a crew's galley, lavatory and toilet spaces, bathrooms and shower baths and a hospital together with required stairs and ladders.

Extension of Superstructure

The midship bridge house structure at *A, B* and *C* decks will be extended forward to frame 73½ and *A* deck with its house aft to frame 168. Within this extension a portion of the new passenger and crew accommodations will be arranged. These extensions necessitated the removal of the existing deck house on *D* deck between frames 73 and 98 and also the elimination of two existing cargo hatches between frames 82 and 104 which pass through *D, E* and *F* decks and the one cargo hatch between frames 153 and 157 through *B* to *F* decks inclusive.

The existing pilot house and chart house will be removed and replaced with a teak house of slightly larger dimensions.

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General Data: Passenger and Cargo Steamship President Buchanan

General Information

Service: North Trans-Atlantic Passenger Service.
Builder: Harland & Wolff, Belfast. Built in 1907.
Owner: U. S. Shipping Board.

Characteristics

Length, overall	615′ 3″
Length, B. P.	600′ 0″
Breadth, molded	68′ 0″
Depth, molded to "D" deck	52′ 0″
Draft, loaded	33′ 0″
Block coefficient, approx.	0.76
Speed, loaded, knots, normal	13½ knots
Framing, transverse, spaced	30½″
Class	American Bureau of Shipping

Tonnages

(In tons of 2,240 pounds)

Displacement at 33′ draft	29,250

(In tons of 100 cubic feet)

Gross register when reconditioned	18,400
Net register when reconditioned	13,500

Complement

Deck officers	8
Deck crew	15 petty 36 seamen
Engineer officers, incl. deck engineers	14
Engineer crew	43
Purser's and steward's department	238
Total officers and crew	354
First-class passengers	717
Second-class passengers	none
Third-class passengers	1,424
Total passengers	2,141
Total complement	2,495

Life Saving Equipment

Lifeboats	No.	Type	Length
Metallic	2	1-A	24′
Metallic	36	1-A	30′
Metallic	4	1-A	26′
Motor	2	...	30′

Propelling Machinery

Boilers

Number	4 D.E. and 2 S.E.
Type	Scotch
Length	D. E.—19′ 0″ S. E.—10′ 9″
Diameter	D. and S.—15′ 6″
Fuel	Oil
Draft	Howden Forced
Total heating surface, square feet	23,503
Total grate surface or furnace volume	567
Superheat, degrees F.	
Working pressure, lbs. per sq. in.	215

Engines

Number	2
Type	4-Cyl. Quad. Expansion
Size	25 x 36 x 52½ x 75 x 54
Horsepower	7,500 I. H. P.

Refrigerating Machinery:

Two 15-ton York CO_2 Compressors
Two CO_2 Condensers
Two Evaporators
Brine and Circulating Pumps.

Electric Equipment:

Generators	Turbo, 3, 200-kw.
Radio	
Emergency	Diesel Generator, 1, 50-kw

Bunkers

Compartment	Tons
Total fuel bunker capacity	3,130

Auxiliary Machinery

Condensers, main, surface type, 1,671 tubes each, diameter, ¾ inch, length of tubes, 18 feet	2
Condenser, auxiliary, to be replaced	1
Air pumps, main, attached to main engines	2
Bilge pumps, attached to main engines	2
Water service pump, attached to main engine	1
Sanitary pump, attached to main engine	1
Main circulating pumps	2
Main feed pumps, Weir type, 14 1/16 inches by 9⅞ inches by 27⅝ inches, drawing water from common float tank located beside pumps and discharging into feed pipe before passing through feed heater	2
Auxiliary feed pumps, vertical simplex	1
Vertical duplex (Either pump will handle all requirements)	1
General service pump, simplex type, size 17½ inches steam end by 11 inches water end by 19 inches stroke	1
Ballast and fire pumps, duplex double acting, 9 1/16 inches by 10 7/32 inches by 14¾ inches	1
Ballast and fire pumps, duplex, 10½ inches by 7½ inches by 12 inches	1
Bilge pump, vertical duplex	1
Auxiliary feed pump, 7 inches by 5 inches by 12 inches	1
Fresh water pumps	4
Main sanitary pump	1
Auxiliary sanitary pump	1
Fuel oil pumps, vertical simplex, 2 inches, each pump room	4
Fuel oil heaters	2
Fuel oil transfer pumps, one in each pump room, 7½ inches by 9 inches by 10 inches	2
Oil burners	30
Evaporator, vertical multi-coil type	1
Distiller, vertical multi-coil type	1
Feed water heater, multi-coil type	1

Deck Machinery

Steering gear, consisting of two compound vertical engines controlled by hydraulic telemotor	1
Anchor windlass, also used for warping	1
Winches	18

Machine Shop

Lathes	3
Drill press	1
Drill press, electric portable	1
Emery wheels	2
Hand pump press	1
Electric motor	1

This will make it necessary to move the navigating bridge structure to suit the new house.

Rearrangement of Pillars and Girders and Removal of Structural Bulkheads

Where existing pillars, girders or bulkheads interfere with the arrangement of the new accommodations, or with proper access to them, they will be removed and re-located in such a manner as to obviate interference. This means that in several places existing steel bulkheads not fitting in with the new arrangement will be removed but where such bulkheads act as supports for decks, suitable pillars or other structure will be substituted.

New Watertight Bulkheads

Two new main watertight bulkheads will be installed, one at about frame 77 extending from *G* to *D* decks and the other one at about frame 189 extending from the inner bottom to *D* deck. Where watertight bulkheads are modified or relocated, the decks forming watertight flats in way of them will be reconstructed to maintain the watertightness of the compartments. All watertight bulkheads shall comply with the requirements of the American Bureau of Shipping to withstand a test head of water to *D* deck. As the new watertight bulkhead at frame 189 divides the existing cargo refrigeration compartment on *H* deck into two parts it will be necessary to make changes in the insulation, piping and similar details.

Air Ports and Fixed Lights

All existing air ports and fixed lights below *E* deck within passenger and crew accommodations and storeroom will be removed and replaced with 10-inch clear glass fixed lights fitted with dead covers. Additional ports and lights will be fitted as indicated on the contract plans. At *E* deck the existing 12-inch and 14-inch clear glass air ports will be retained but all those in the cabin, dining saloon, galley and pantry compartments will be made 14 inches. Laycock frameless lights shall be fitted in the *B* and *C* promenade deck spaces as shown on the plans.

Dining Saloon

The dining saloon will be completely reconstructed and rearranged so that more expeditious service can be provided for the passengers. In this connection, the galley equipment will be improved and modernized in every way, including the installation of an entirely electric cooking apparatus, ranges, etc.

Deck Coverings

In general all passenger, officer and crew accommodations and the passenger hospital spaces, with the exception of lavatory and toilet spaces, will be laid with Lit-O-Sil-O flooring; where practicable, however, the existing Lit-O-Sil-O flooring shall be retained and such portions as are damaged will be removed and replaced. The existing wood decking in the original second class dining room will be removed and replaced with Lit-O-Sil-O.

Lavatory and toilet spaces, baths and laundries, crew's hospitals, isolation hospitals and operating room will be laid with vitreous tile, galley and pantry spaces will be laid with quarry tile. The staterooms will be laid with carpets, and rugs will be furnished for the social hall, the writing room and ladies' saloon. A portion of the social hall will be laid with maple flooring for dancing.

Artificial Ventilation and Heating Systems

The entire existing artificial and natural ventilation systems in the passenger, officer and crew accommodations, including supply and exhaust fans and their ducts, will be removed and new systems installed. Electrically-driven supply and exhaust fans will be installed in connection with

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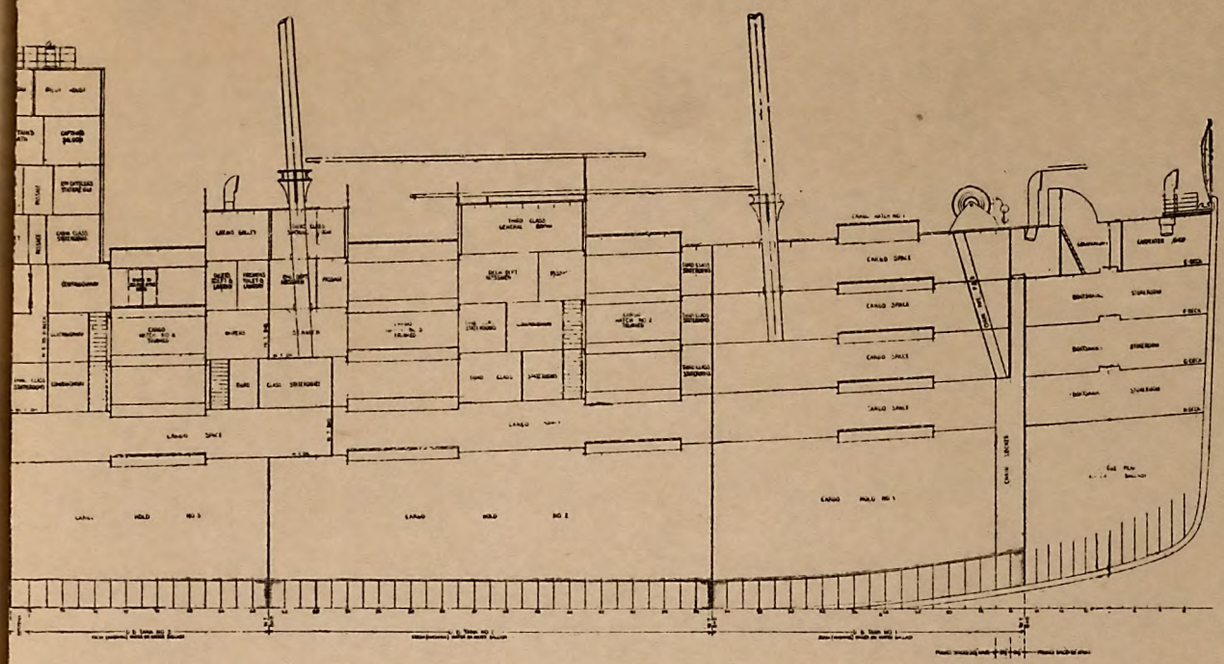

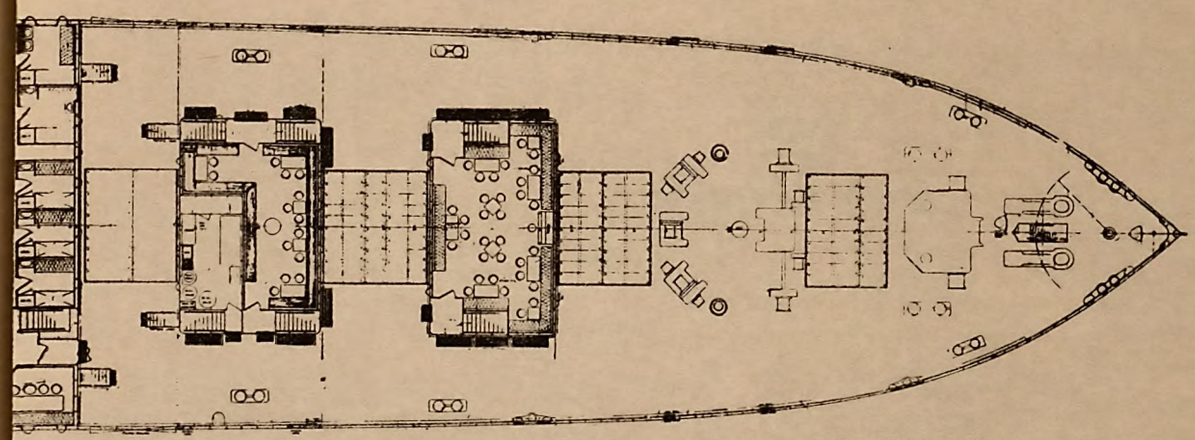

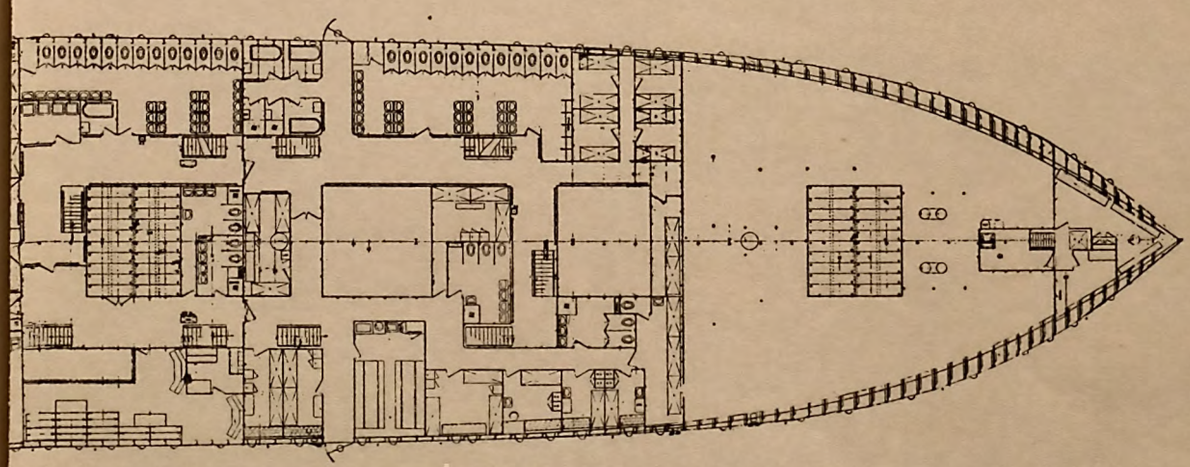

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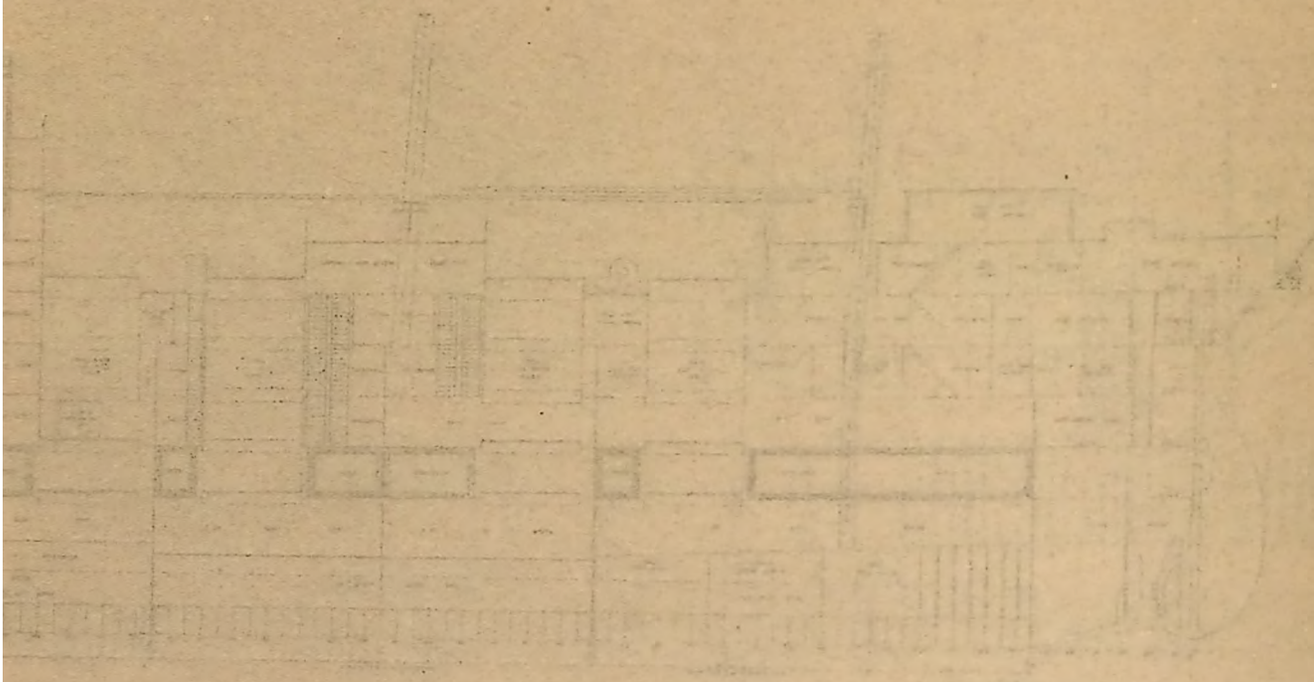

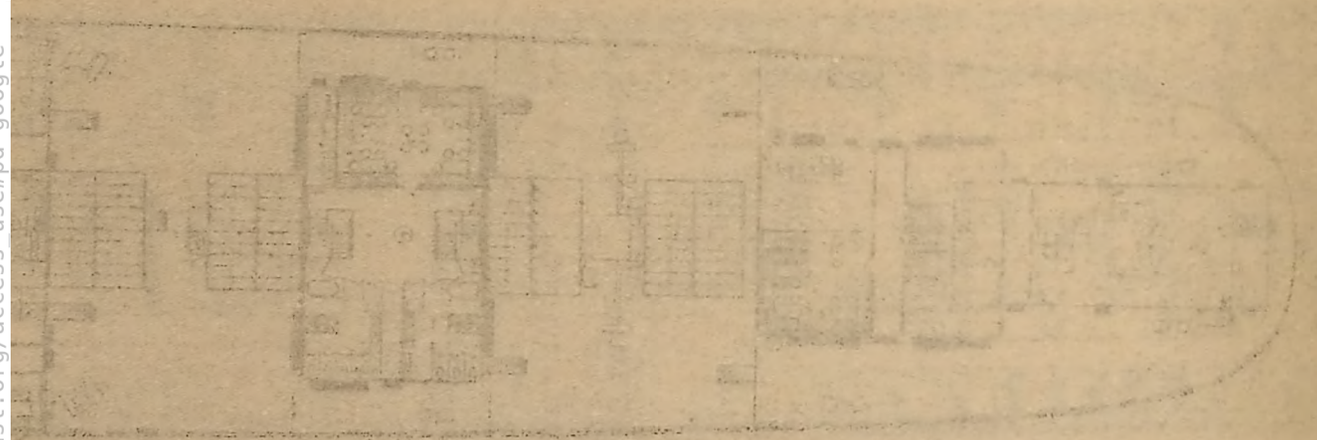

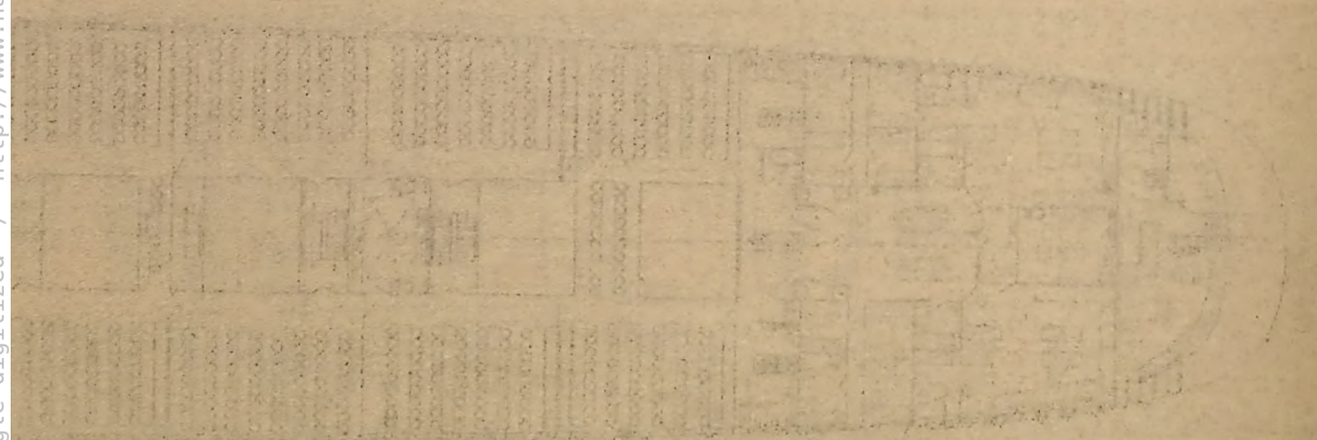

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these new systems in conjunction with thermotanks for the heated air supply systems. The air supply to inside rooms in cabin passengers' staterooms on *B*, *C* and *D* decks and to all cabin passengers' staterooms on *F* and *G* decks and to all officers' and crew's staterooms, berthing spaces and messrooms below *D* deck, galley and pantry spaces below *D* deck will not be artificially heated. The air supply to the cabin class social hall, writing and ladies' saloon, smoking and dining room and to all third class staterooms and dining room, hospital spaces, etc., will be artificially heated. Artificial air exhaust systems will be installed from all toilet and lavatory spaces and bathrooms except from the third class lavatory and toilet spaces in the house on *D* deck aft and from all galley and pantry spaces except the galley in the deck house on *D* deck forward.

Cargo Hold Ventilation

Existing natural supply and exhaust ventilators to compartments will be retained but those that are not found in serviceable condition will be replaced. However, cargo spaces now assigned to other purposes will have their ventilators removed and new systems installed.

Steam Heating System

The existing steam heating system will be removed and a new one with cast iron wall type radiators and copper pipe sill heaters will be installed in the passengers', officers' and crew's accommodations.

Steam Cooking and Water Heating System

The existing steam cooking and water heating system will be removed and a new system installed. This will consist of a steam supply for cooking and water heating in galley, bakery, butcher shop, pantry and messrooms and the hot water heating system in the seamen's, oilers' and firemen's washroom and water heaters in the stewards' slop lockers, laundries, hospital spaces, etc., and a salt water heater which will supply all bathtubs and washers except those in the hospital.

Plumbing

All existing plumbing fixtures, fittings and piping will be removed and new systems installed. Free standing cast iron enamel tubs supplied with hot and cold salt water will be fitted in all bathrooms with the exception of those in the hospital spaces which will receive a fresh water supply from local heaters. In the third class and crew's spaces nickel plated brass washer heads supplied with cold and hot salt water will be fitted. Practically all cabin passenger staterooms, public lavatory spaces, officers' and petty officers' staterooms will be furnished with cast iron enamel lavatories supplied with cold fresh water and fitted with drains. Similar lavatories will be fitted in the hospital spaces and supplied with fresh hot and cold water.

Fresh and Salt Water Piping System

The whole of the existing fresh and salt water piping system will be removed and new systems installed. Features of the new systems will be cold fresh water for washing purposes which will be led to all lavatories in cabin passenger staterooms except those in *G* deck and to cabin and third class public lavatory spaces and to officers' staterooms and to such places as galley and pantry spaces, messrooms, operating room, etc.

Another feature will be running ice water which will be supplied to the cabin and third class pantries, service pantries, officers' and crew's messrooms and to drinking fountains in all third class passenger berthing spaces and to engine and boiler rooms. This ice water system will be operated as follows: New pumps located in the engine room will take water from the drinking water tanks and force it through two filters and a riser to a brine cooled scuttle butt located under the engine hatch from where it will be distributed by means of a circulating piping system.

Fire Detecting and Extinguishing System

Fire detection as well as extinguishing apparatus will be installed to cover all cargo spaces and will be on the Rich system. The whole of the existing fire alarm system will be removed and a new manual operated fire alarm system installed in the cabin and third class passengers' and officers' accommodations, crew's spaces, engine and fireroom and refrigeration spaces. This will be supplemented further with an automatic fire alarm system covering all spaces and compartments.

Power and Lighting Distribution

A complete new system for the distribution of electric power and lighting current will be installed in all parts of the vessel and will include portable lighting fixtures in the cargo spaces. This will necessitate the removal of the whole of the existing power and lighting distribution system.

Interior Communication System

All of the existing interior communication system, including wiring, fixtures and telephones will be removed and the following new systems installed complete, viz., cabin passengers' annunciator system, cabin smoking room annunciator system, deck officers' annunciator system, engineering officers' annunciator system, stewards' annunciator system, cabin, pantry and galley call bell system, watertight door communicating system, refrigerator door communicating system and siren control system, life buoy release, loud speaking telephone system, inter-telephone (5 station) system, mechanical talking and steering telephone system (reconditioned) helm angle communicating system, wiring for submarine signal system, voice tubes and gyro compass installation.

Lifeboats

The vessel will be equipped with new lifeboats and handling gear capable of accommodating 2,670 persons. Two motorboats and 42 lifeboats will be installed and they will be operated by mechanical davits.

Cabin Class Joiner Work

In general each stateroom will have one permanent berth, one sofa berth and one or more Pullman type berths. Wardrobes will be built-in and of laminated hard wood with a mahogany finish. Two fold-up seats of hard wood secured to the bulkhead shall be provided for each stateroom except where there is not sufficient room, in which case two camp stools or one seat and one camp stool will be provided.

Gyro Compass

A gyro compass system of the Sperry merchant type and of the latest design will be installed. There will be one master gyro compass, one compass control panel, two alarm indicators, two motor generators, two dynamometers, two storage batteries, one set of dry cell batteries, one steering repeater with reading glass and cover for the wheelhouse, one steering repeater mounted in a waterproof stand at the aft docking bridge, one bulkhead type steering repeater in the captain's stateroom, one continuous course recorder for chart room and two bearing repeaters with pelorus stands for mounting on the bridge wings.

Fuel Oil System

Many changes and additions to machinery and piping will be necessary to convert the vessel into an oil burner.

The filling stations will be between frames 119 and 122

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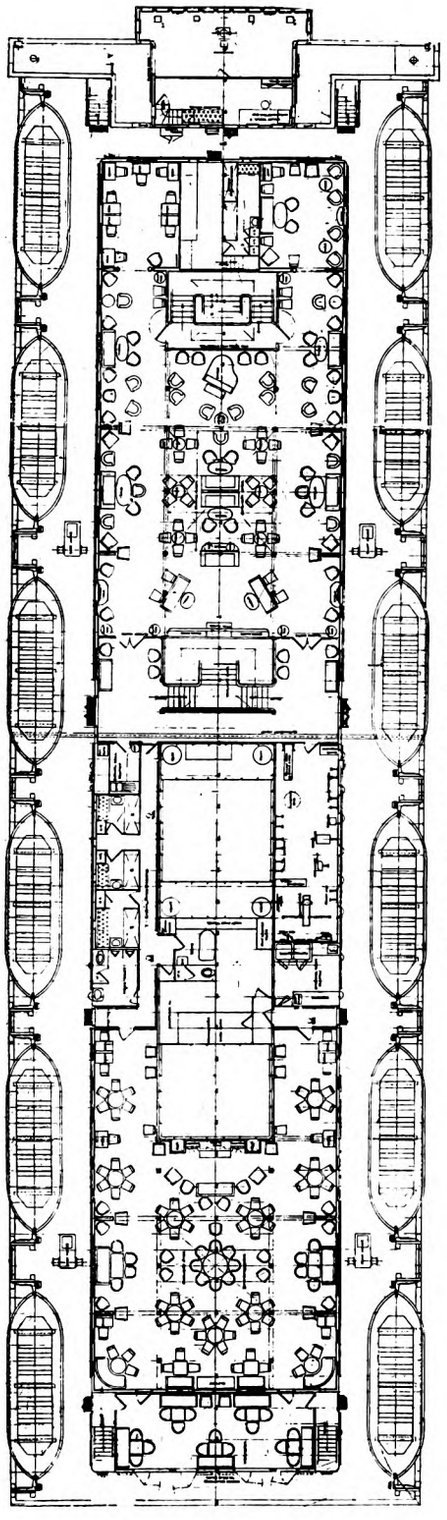
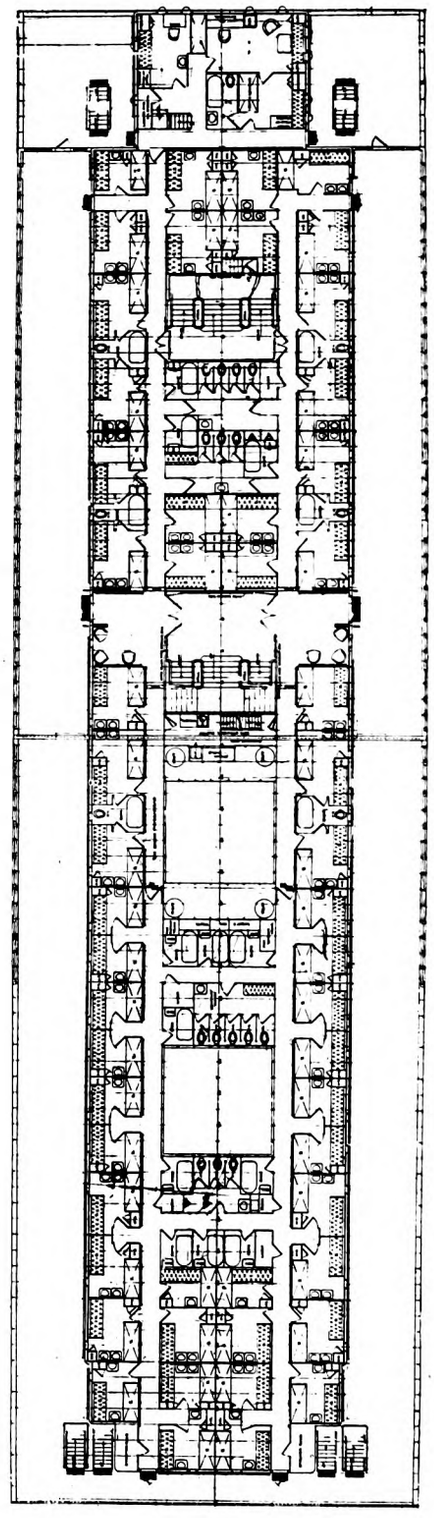


General Arrangement of A Deck



General Arrangement of B Deck

on *E* deck and shall be carried through a 10-inch filling main and 8-inch transfer lines alongside of a new pipe tunnel to be constructed through deep tanks between frames 79 and 110. The inboard deep tanks between frames 101 and 110 will be used as settling tanks and will be connected to the fuel service system by high and low pump suctions.

Oil Filling Connections

There will be 10-inch flange filling connections with strainer fitted in each filling station with 10-inch pipes led through *E* deck to a suitable height above *F* deck along through side of fidley and down to about 12 inches below deck with 10-inch gates connecting pipes terminating in a tee near centerline. From this tee a 10-inch pipe will be led through fidley to connect with transfer lines as specified elsewhere. The 10-inch fuel oil filling line will lead to a point at centerline of ship and just aft of forward boiler room boiler, where it will terminate with a 10-inch gate valve. Below this valve there will be fitted a cross fitting with 5-inch branches to each settling tank. Eight-inch transfer lines will lead up each side of pipe tunnel with suitable manifold for filling and emptying individual tanks. These lines will be cross connected after last manifold with a gate valve and cross over pipe.

Ballast System

The ballast system is to be changed so as to provide means for filling or pumping out all double bottoms, fore and after peaks and deep tanks abreast the thrust recess used for carriage of washing water. The present cast iron and steel ballast line will be utilized wherever possible but any defective material is to be removed.

Refrigerating Machinery

Two 15-ton York CO_2 compressors driven by single vertical engines will be installed to replace present machinery which will be removed along with its evaporator. There will also be two CO_2 condensers fitted and each will be of sufficient capacity to accommodate one machine when operating at its maximum capacity.

Tank Gaging, Sounding and Signaling Systems

The conversion of double bottoms to oil tanks will require the installation of sounding pipes in every tank and pneumercators or some other method for determining the height of oil in service in storage tanks will be fitted.

Boiler Room

In the boiler room a new single ended boiler equipped with Howden forced draft system will be installed. This boiler will be located on the port side of the centerline of the vessel abreast of an existing single ended boiler.

Electric Generators

Three new electric generators are to be fitted each capable of developing 200 kilowatts at 1,000 revolutions per minute.

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They are to be driven by geared turbines operating at 5,000 revolutions per minute. Turbine and generator will be mounted on a common bedplate.

These turbines are to be capable of operating under a boiler pressure of 215 pounds per square inch when exhausting against a back pressure of 15 pounds above atmosphere. With normal steam pressure of 200 pounds per square inch and a back pressure of 10 pounds per square inch at the gage the requirements for steam consumption for half and full loads will be as follows: At full capacity, 52 pounds and at half capacity, 62 pounds.

The deep tanks and settling tanks will have a capacity of about 3,130 tons of fuel oil. Fourteen tanks, including the two settling tanks, will be constructed forward of the boiler room, extending from frame 79 to frame 111 and from top of double bottom to *G* deck. This will involve the construction of two new oiltight bulkheads and an oiltight pipe tunnel on the double bottom at the centerline.

MACHINERY ALTERATIONS

The main and auxiliary propelling machinery and boilers will be given a complete overhauling and the term "overhauling" means that every item in the engine department will be given a thorough examination and all defective parts will either be reconditioned or renewed. The main engines, which consist of two vertical inverted quadruple expansion engines, will be given very careful attention and placed in first class operating condition.

Propellers—II

Factors Which a Propeller Formula Should Contain—Application of Froude's Formula to Full Size Propellers

By Alfred J. C. Robertson*

IN the preceding article the writer has shown how propeller data such as are given in Taylor's paper on "Propeller Position" (MARINE ENGINEERING AND SHIPPING AGE, December, 1922) can be used for the calculation of wake and thrust deduction from trial trip results and also how such data may be utilized for design purposes. Unfortunately, however, there is still very little of such propeller data available and it will therefore be interesting to see whether formulæ such as Froude has used for his propellers will be of assistance to us.

But before trying to express the work of a propeller mathematically it will be necessary to refer to the various elements of a propeller as regards their effect upon the absorption or giving out of work.

PITCH RATIO

By far the most important element is the pitch ratio, the ratio of pitch to diameter. Assuming fixed diameter and revolutions, and speed of advance, there is always a pitch ratio at which the propeller does no work. A propeller of less than this pitch would tend to reduce the speed of advance, i. e. would absorb thrust instead of giving it out. As the pitch is increased the slip ratio increases and thrust also increases with a somewhat lesser increase of torque until maximum efficiency is reached and thereafter the rate of increase of torque is somewhat greater than that of thrust representing a continuous increase of horsepower but a decrease of efficiency.

The slip at no thrust is usually termed the effective slip and the corresponding pitch is equal to the speed of advance in feet divided by revolutions. This effective pitch is nearly always greater than the face pitch of the screw.

In Taylor's propeller No. 570 there is a condition of no thrust at—.07 percent slip, i. e. face pitch is 93 percent of effective pitch. For propeller No. 569 the effective slip is $\frac{1}{.91}$ of face slip, and for No. 571 the ratio is $\frac{1}{.88}$.

It is evident therefore that the thrust developed is dependent upon the effective pitch ratio in conjunction with the effective slip ratio, and highest efficiency is reached at about 21 percent effective slip for a pitch ratio of 1.5 and about 26 percent for a pitch ratio of .8 the slip for highest efficiency increasing with decrease of pitch.

BLADE AREA

The next propeller element of importance is the blade area, either developed or projected, and with area we must consider its distribution in two, three or four blades; and the shape of the blades, whether elliptical or wide tip. We must also consider the size of the propeller boss which naturally affects the shape and area of the propeller blades.

For comparative purposes it is necessary to express blade area by a ratio of the diameter, as mean width, or of 0.785 $\times$ diameter squared as a ratio of the propeller disk.

It should be noted that area is important in the development of thrust, but that thrust does not increase nearly as fast as increase in propeller area, and efficiency generally decreases as the area ratio increases.

The same principle apparently applies in reference to the number of blades, but to a less extent—there is a small sacrifice in smooth water efficiency by increasing the number of blades in excess of two, but the difference is small and is generally more than offset by the more even torque, and there is a distinct advantage as regards stress conditions in the material of the blade, where three or four blades are used instead of two.

PROPELLER BOSS EFFECT

The propeller boss effect has never been accurately measured but as it affects the stream line motion through the propeller disk as well as the shape and center of effort of the propeller blade it is necessary to take some account of it. In general, Taylor's propeller bosses have a diameter of 20 percent of the propeller diameter and, if this rule is adhered to, comparative bossing effects will be eliminated.

Regarding the outline of the blade, many claims have been made for particular shapes, but no shape has been proved more efficient than a true ellipse and this shape is probably as strong as any so that there is no reason to depart from it.

The remaining propeller element having any important bearing on its thrust or efficiency is the blade thickness.

*Naval architect, Munson Steamship Line, New York.

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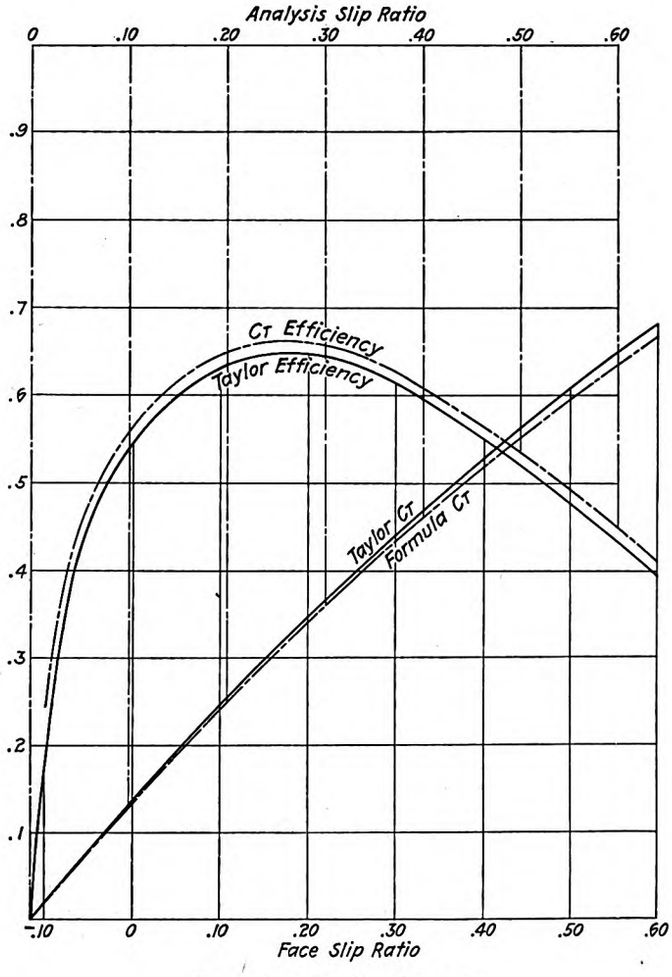
This is best expressed for comparative purposes as the axial thickness.

The blade face and back are usually straight lines extending from the propeller centerline to its circumference at somewhat different angles and meeting at the blade tip. The distance on the fore and aft centerline of the propeller which separates these two lines is termed the axial thickness and is expressed as a ratio of the diameter. This axial thickness is a necessary evil, but may be reduced as the mean width of the propeller is increased and in Mr. Taylor's data this is done. Mr. Froude adhered to the same axial thickness throughout his experiments.

Propeller Formulæ

Any propeller formula should therefore contain, in addition to diameter, revolutions and speed of advance, factors



Taylor's Propeller No. 571

expressing the blade area and shape, the pitch ratio and the slip ratio.

Froude's propeller formula is:

$$\text{Thrust Horsepower} = Va^3 \times D^2 \times B \frac{(p+21)}{p} \times \frac{S}{310.9} \times \frac{(1-.08S)}{(1-S)^2}$$

where Va is speed of advance of propeller in knots, D is diameter in feet, B is a blade factor depending on the number of blades, their area and their shape, p is analysis pitch ratio, and S is analysis slip ratio. It will be noticed that the above formula does not include any adjustment of power due to variation of boss diameter or axial thickness. The former is partially covered by disk area ratio on which B values are plotted and the axial thickness is important chiefly as it affects true (analysis) pitch, but there is room for further study along both these lines.

For application to full size propellers, Froude concluded that analysis pitch should be assumed as two percent higher than face pitch, and this is the particular feature of Froude's data which causes doubt and confusion.

In examining a number of propeller data curves, the writer has concluded that the slip correction factor $(1 - .08S)$ could well be modified to $(1 - S/3)$ and with this correction C_T may be written:

$$C_T = \frac{B}{2.723} \times \frac{p+21}{p} \times S\,(1-S/3) \times \left(\frac{\text{Analysis Pitch}}{\text{Face Pitch}}\right)^2$$

$$\text{and } T.H.P. = \frac{C_T \times R^2 P^2 D^2 V}{117.24}$$

where R = Revolutions in hundreds.
P = Face pitch in feet.
D = Diameter in feet.

the constants 2.723 and 117.24 being simply dimension correction factors.

A curve of C_T is shown herewith plotted by formula, together with Taylor's experimental C_T for propeller No. 571, and it will be noted that the C_T curves would coincide if "B" value were taken at .1084 instead of .1066. Such a difference would easily be accounted for if corrections for diameter of boss and axial thickness were included in the formula*.

A very convenient way of plotting propeller data is a modification of Taylor's $\rho\delta$ diagram suggested by a study of Froude's formulæ.

On a base of Taylor's ρ = Revs. $\sqrt{\frac{Q.H.P.}{Va^5}}$

or, more conveniently for use where the effective horsepower is known from tank tests, on Revs. $\sqrt{\frac{T.H.P.}{Va^5}}$ curves of $\frac{D \times R}{Va}$

may be plotted for each pitch ratio, with corresponding efficiency and slip ratio curves, so that it is possible by inspection at once to select the best diameter for any particular problem and its corresponding pitch ratio; and the slip ratio may also be read off, this factor being necessary for the analysis of trial results.

Where the effective or analysis pitch is unknown, face pitch can be used as Taylor has done. It is, however, interesting to note that curves of C_Q and C_T may be plotted by formula on face slip ratio, the formula of course having adjusted blade coefficients and including the addition of C_Q and C_T values at zero slip ratio, these quantities being expressed by a formula which includes the various blade elements.

There is quite a discrepancy as a rule between the results of a ship on the measured mile and the results reported in the ship's log and until the discrepancies between these two sources of data are satisfactorily explained it is difficult to make any material advance in our knowledge of propeller performances.

There is no doubt that the average weather at sea adds to the resistance of a ship over that experienced in smooth waters on the measured mile, but there is also no doubt that the I. H. P. reported at sea, or even the S. H. P. by the torsion meter, give far from satisfactory results and can hardly be relied upon within five percent, even when carried out with care. But, in many cases the engineers, seeking to get all the credit they may in fuel economy, will take indicator readings at the maximum power in a day's run. This gives us a low figure for the fuel consumption but gives us

(*Continued on page 239*)

*Froude's boss diameter was 9 percent of diameter; Taylor's is 20 percent. Froude's axial thickness was 3 percent of diameter; Taylor's is 4½ percent.

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Recent Motorship Building In Europe

Large Number of New Motorships and Motor Liners Now Under Construction and in Contemplation

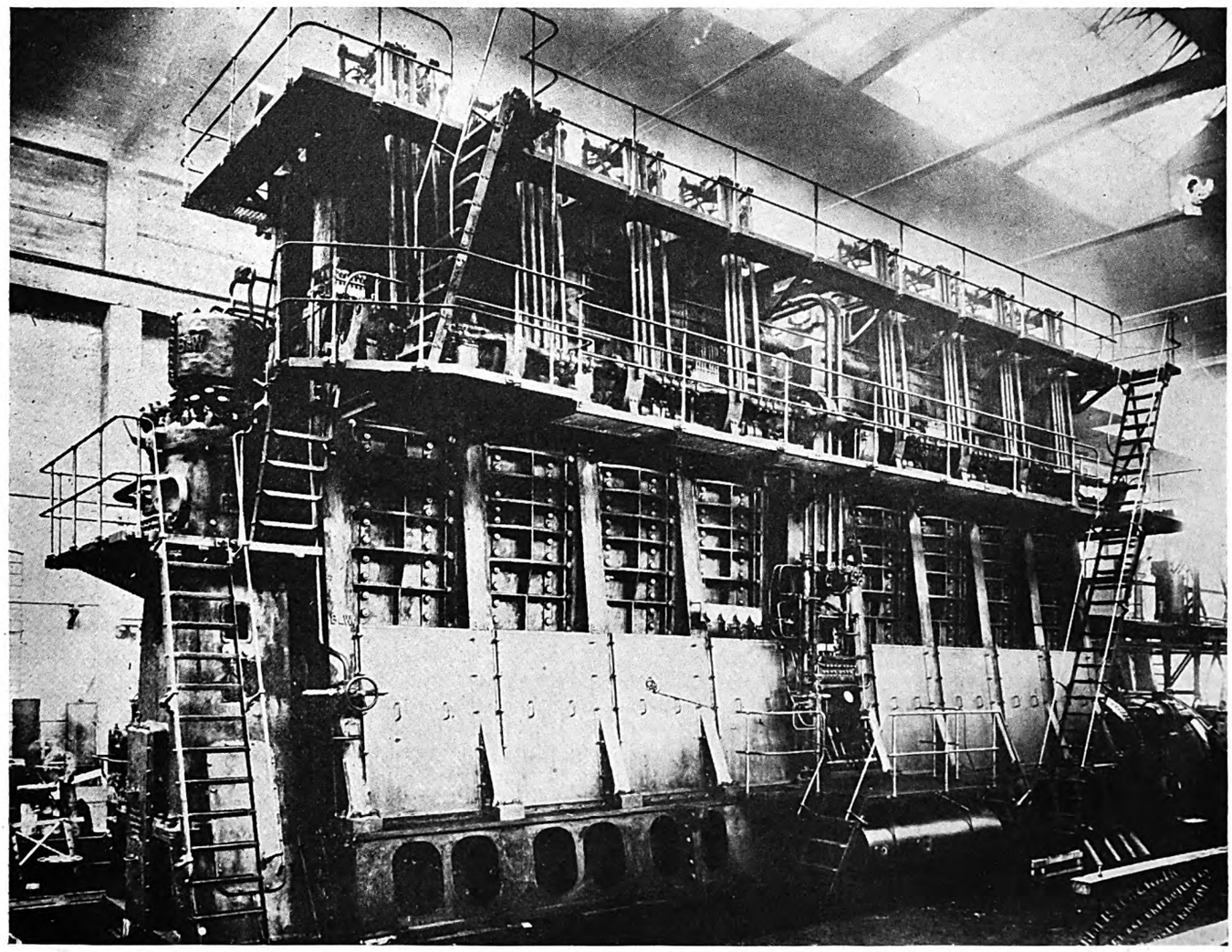
By Our Special London Correspondent

PARTLY because of the increasing confidence which is now felt in the marine internal combustion engine, and partly because of the shipowner's undoubted preference for single screw motorships, there is now a marked tendency in Europe to build vessels of this class. Orders have recently been placed for nine or 10 motorships totaling about 60,000 tons deadweight, the installation in each case comprising a single Doxford opposed piston engine of 2,000 or 3,000 brake horsepower. The Holt Line is having a 10,000-ton vessel constructed in which will be fitted a 3,000 brake horsepower six-cylinder Camellaird Fullagar engine, running at 85 revolutions per minute, this being the largest of its type yet produced, while Messrs. Fearnley and Eger of Christiania, have ordered two 7,500-ton single screw ships, each equipped with a 2,600 brake horsepower motor.

In single screw vessels, relatively low speed of rotation is, of course, essential for high propeller efficiency and all of the engines used for the purpose are of what is termed the long-stroke design with a high stroke-bore ratio, the speed varying between about 75 and 85 revolutions per minute. It might be thought that in this connection, the two stroke type would show to special advantage, particularly in the higher powers. This is undoubtedly the case, but builders of the four-cycle Diesel engine have tackled the problem energetically, with the result that long-stroke, slow-speed motors of this design, are now being constructed in powers up to 3,000 indicated horsepower.

New Burmeister and Wain Engine

The first example of such an engine has just been completed by Burmeister and Wain, and is now being installed in an 8,000-ton cargo vessel, under construction at Palmers' Yard on the Tyne, for the Ocean Steamship Company, of Liverpool. Its full output of 3,000 indicated horsepower is developed at 85 revolutions per minute and as will be seen from the illustration, it is an eight-cylinder type with a single three-stage air compressor. This is a point of some interest since in the 3,000 indicated horsepower Burmeister



The First 3,000 Indicated Horsepower Burmeister and Wain Long Stroke Engine for a Single Screw Ship

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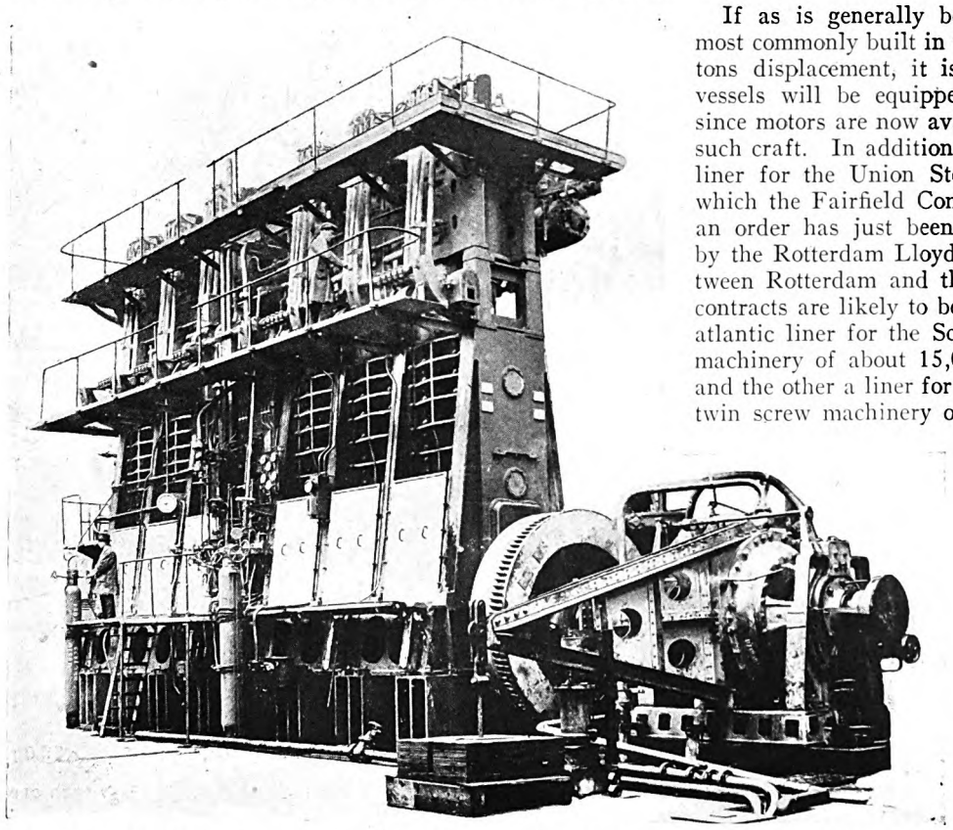
and Wain engine used in twin screw ships (running at 115 revolutions per minute), two air compressors in tandem have invariably been provided. Equally noteworthy is the fact that in the ship in question, there is to be no electrically driven auxiliary compressor for the supply of air for starting and maneuvering purposes. It is considered that the surplus air from the compressor on the propelling engine and the individual three-stage compressors on the Diesel engines driving the electric generators, will be sufficient for all purposes.

The engine has cylinders 29.13 inches in diameter and a 59.06-inch stroke, the bore being the same as that of the short stroke engine of the same power, while the stroke is 13.78 inches greater. There is, however, little difference in the piston speed, which in this motor, is about 820 feet per minute. This is a figure which experience has shown, may well be exceeded and the builders are already prepared to construct eight-cylinder engines on the same principle developing 4,000 indicated horsepower. Incidentally it may be stated that the mechanical efficiency is in the neighborhood of 80 percent and the shaft horsepower developed by the engine illustrated is slightly under 2,400.



1,800 Brake Horsepower Long Stroke Diesel Engine Built by Harland and Wolff

No Variation in General Design

There is no variation in the general design of the long-stroke engine in comparison with the normal type, apart from the minor modification in construction necessitated by the long-stroke, and the adoption of a single, instead of two compressors. Harland and Wolff, the British licensees of Burmeister and Wain, have just completed two engines of the same type but with six cylinders, the output in this case being 1,800 brake horsepower at 85 revolutions per minute. In order to obtain increased flexibility of operation, an arrangement has been devised whereby at low speed, the lift of each of the fuel valves in the six cylinders may be diminished.

This operation is carried out by turning a handwheel at the starting platform and by means of a system of levers and a lay shaft, the lift of all the fuel valve spindles is regulated at the same time. On the test bed it was found that in this way the speed of the engine could easily be controlled down to about 20 revolutions per minute. So far as the method of valve operation and reversing are concerned, no alteration has been made from normal practice. The first of these engines built by Harland and Wolff has been installed in a 6,500-ton vessel built in Spain for the Sota y Aznar Company, while the second is for a 7,800-ton cargo ship for Messrs. MacIver and Company, Liverpool.

A 15,000-Ton Motor Liner

If as is generally believed, the type of passenger liner most commonly built in the future is one not exceeding 20,000 tons displacement, it is probable that a majority of these vessels will be equipped with internal combustion engines since motors are now available, suitable for the propulsion of such craft. In addition to the 22,000-ton, 18-knot passenger liner for the Union Steamship Company of New Zealand, which the Fairfield Company is now building on the Clyde, an order has just been placed for a vessel of 15,000 tons by the Rotterdam Lloyd Steamship Company for service between Rotterdam and the Dutch East Indies. Two further contracts are likely to be fixed in the future, one for a trans-atlantic liner for the Scandinavian American Line in which machinery of about 15,000 brake horsepower is to be fitted, and the other a liner for the United Steamship Company with twin screw machinery of 14,000 brake horsepower. In this latter ship it is stated that two double acting four-cycle engines of a new type will be installed.

Largest Installation Yet Constructed

The new liner for the Rotterdam Lloyd Steamship Company, which is being built at the De Schelde Shipbuilding & Engineering Company's yard at Flushing, will be 500 feet long and will have a draft of 27 feet. The propelling machinery will comprise two Sulzer two-cycle engines each of 3,500 brake horsepower with six cylinders, and the notably low speed of 85 revolutions per minute will be adopted. The two motors will be the largest that have yet been constructed for installation in a ship, and it is a matter of interest that they are to be built under license by the Dutch firm which has not hitherto engaged upon the manufacture of marine Diesel engines.

Turbo Blowers Will Supply Scavenging Air

The motors will be of the standard Sulzer type with auxiliary port scavenging and the new system of providing scavenging air by means of separately driven turbo blowers will be utilized, instead of having piston scavenging pumps driven off the engine crankshaft. There will probably be three of these blowers, each driven by a direct current motor of about 200 brake horsepower and two sets will be in operation when the vessel is at sea. This will naturally involve very large electric generating equipment, and Diesel engines totalling 1,500 brake horsepower will be fitted, driving the generators. The liner will carry about 400 passengers at a speed of 15 knots, in addition to a certain amount of cargo. All the auxiliary plant will be electrically operated, including winches, steering gear and engine room pumps. It is understood that the new ship will be completed about the same time as the liner for the Union Steamship Company, namely, towards the end of the summer of 1924.

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Dyson's Method Applied to Merchant Ship Propellers*

By E. A. Stevens, Jr.

During the transactions of this society in 1920, *Admiral C. W. Dyson presented a paper entitled "The Problem of the Hull and Its Screw Propeller," in which a number of examples were shown. These were all navy vessels with the exception of the first problem. It has been claimed by many that, while this method is very accurate for these vessels, especially those fitted with twin screws, the block coefficients of which do not exceed* 0.65, *it might not be applicable to merchant ships with full lines and fitted with one propeller. The writer presents in this article several ships of this type, together with other types of merchant ships, and shows the results of Dyson's analysis, together with the results obtained on the trial trips.*

AN argument used against Dyson's method is that while the anticipated power and revolutions obtained by the calculation compare favorably with those developed on the trial trip, the same cannot be said regarding the power and revolutions per minute obtained at sea. This, however true it may be, is not due to the method but to the way it is used. In the latter case, an addition of 20 to 30 percent should be made to the effective horsepower of the ship as found from the model test.

Before attacking any of the problems it might be well to mention one thing. The basic slip (S) is dependent not only on the corrected block coefficient but also on the ratio of twice the length of after body divided by the draft. In a few cases coming to the writer's attention, it was impossible to obtain the length of after body. In order to make a reasonable estimate of this length, about forty-five ships were plotted with block coefficients as abscissas and length of after body divided by length between perpendiculars as ordinates. These varied considerably, but a fair average would be as shown in the following table:

B. C.	L. A. B. / L. B. P.	B. C.	L. A. B. / L. B. P.
0.60	0.50	0.725	0.407
0.625	0.494	0.750	0.376
0.65	0.48	0.775	0.339
0.675	0.46	0.80	0.302
0.700	0.436	0.825	0.265

If the ship is fitted with a cruiser stern, the length of waterline should be used in place of length between perpendiculars.

If the above table is used for obtaining the length of after body, quite accurate results will be obtained as, in the majority of cases, it requires a material change in the basic slip to appreciably affect the revolutions.

The various problems may be divided into three groups: (1) Single-screw vessels; (2) vessels fitted with two or more screws, the wing screws being carried in struts; (3) vessels fitted with two or more screws, the wing screws being carried in bosses or spectacle frames.

Group 1

Problem 1.—The ship used in this problem is the S. S. *Gulfprince,* the trials of which were described by Mr. H. A. Everett in his paper entitled "Power and Speed Trials of Ten Thousand Deadweight-Ton Tanker," which was published in last year's volume of the transactions of this society. It will be noticed that the actual power is less than that calculated at the higher speeds, while at the lower speeds the reverse is the case. As the after body is quite long, the value of K is probably less than that shown on the chart, while the increase in actual power of the lower speeds in relation to that calculated is undoubtedly due to the falling off of the mechanical efficiency of the engine at the lower powers.

Problem 2.—As this model had never been tested in the tank, no effective horsepower curves were available. The revolutions estimated (by using the indicated horsepower developed on the trial) compare favorably with those obtained on the trial. Calculations were then made for the effective horsepower which also compare favorably with an estimated effective horsepower obtained by using Taylor's

Problem No. 1

Hull		Propeller	
L = L.W.L. or L.B.P.	= 419.25	No. of Propellers	= 1
B = Beam	= 56.25	No. of Blades	= 4
H = Draft	= 25.562	Diam. = D	= 18
Δ = Displacement fresh water	= 13,390	Pitch = P	= 15.5
Nominal Block Coeff.	= .801	PA ÷ DA	= .35
M. S. Coeff.	= .98	¾ × PA ÷ DA	= .2625
H ÷ B	= .455	T.S.	= 6.150
Type	= 2	P × R	= 1,685
B ÷ L	= .134	I — S	= .86
B.C. on line C-D	= .688	V	= 14.3
B.C. on line C-D corrected for $\frac{H}{B}$	= .75	I.Ta.	= 2.97
Slip BC line Z	= .845	I.H.P.	= 6,425
LAB	= 146.7	P.C.	= .652
2 LAB ÷ H	= 11.5	E.H.P.	= 1,490
S = Basic Slip	= .14	S.H.P.	=
K.B.C.	= .804		
K	= 1.28		

v	11.5	11	10.5	10	9	8
e.h.p.	1,523	1,315	1,130	973	718	507
e.h.p ÷ E.H.P.	.364	.314	.27	.232	.171	.121
10^{zp}	2.87	3.34	3.92	4.57	6.29	.902
IHPd	2,865	2,460	2,100	1,800	1,310	912
Actual IHPd	2.724	2,392	2,090	1,835	1,355	975
v ÷ V	.805	.77	.735	.70	.63	.56
10^{zs}	1.54	1.76	2.00	2.31	3.13	4.38
s	.096	.094	.092	.091	.089	.087
Rd	83.3	79.4	75.6	72	64.6	57.4
Actual Rd	79.7	76.3	73	69.9	63	56.2

Problem No. 2

Hull		Propeller	
L = L.W.L. or L.B.P.	= 385	No. of Propellers	= 1
B = Beam	= 51	No. of Blades	= 4
H = Draft	= 26	Diam. = D	= 17.5
Δ = Displacement	= 11,590	Pitch = P	= 19
Nominal Block Coeff.	= .793	PA ÷ DA	= .36
M.S. Coeff.	= .989	¾ × PA ÷ DA	= .27
H ÷ B	= .51	T.S.	= 6,290
Type	= 2	P × R	= 2,170
B ÷ L	= .1325	I — S	= .86
B.C. on line C-D	= .676	V	= 18.4
B.C. on line C-D corrected for $\frac{H}{B}$	= .805	I.Ta.	= 3.12
Slip BC line Z	= .882	I.H.P.	= 8,220
LAB	= 145	P.C.	= .646
2 LAB ÷ H	= 11.15	E.H.P.	= 5,310
S = Basic Slip	= .14	S.H.P.	=
K.B.C.	= .795		
K	= 1.255		

v	11.192
I.H.P.d on trial	2,695
v ÷ V	.608
10^{zs}	3,412
s	.152
Rd	70.4
Rd on trial	69.75
e.h.p.₁ ÷ E.H.P.	.302
10^{z_1}	3.48
$10^{zpq} = \frac{IHP \times 10^{z_1}}{IHPd}$	3.257
$10^{zp} = 10^{zpq} \times K$	4.07
e.h.p. ÷ E.H.P.	.26
e.h.p. = E.H.P. × $\frac{e.h.p.}{E.H.P.}$	1,380
Estimated e.h.p.	1,385

*Paper read before the Society of Naval Architects and Marine Engineers, New York, November 8, 1922.

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PROBLEM No. 3

Hull			Propeller		
L = L.W.L. or L.B.P.	=	390	No. of Propellers	=	1
B = Beam	=	54	No. of Blades	=	4
H = Draft	=	24.5	Diam. = D	=	17
Δ = Displacement	=	11,450	Pitch = P	=	14.03
Nominal Block Coeff.	=	.776	PA ÷ DA	=	.374
M. S. Coeff.	=	.996	¾ × PA ÷ DA	=	.27
H ÷ B	=	.454	T.S.	=	6,290
Type	=	2	P × R	=	1,650
B ÷ L	=	.1385	I — S	=	.833
B.C. on line C-D	=	.668	V	=	13.56
B.C. on line C-D corrected for $\frac{H}{B}$	=	.73	I.Ta.	=	3.12
Slip BC line Z	=	.833	I.H.P.	=	5,890
LAB	=	136	P.C.	=	.637
2 LAB ÷ H	=	11.1	E.H.P.	=	3,755
S = Basic Slip	=	.167	S.H.P.	=	5,420
K.B.C.	=	.79			
K	=	1.24			

v	11.38
e.h.p.	1,350
e.h.p ÷ E.H.P.	.36
10^{sp}	2.9
S.H.P.d	2,320
S.H.P.d Estimated	2,500
v ÷ V	.84
10^{sz}	1.37
s	.098
Rd	89.3
Actual Rd	88.8

PROBLEM No. 4

Hull			Propeller		
L = L.W.L. or L.B.P.	=	410.16	No. of Propellers	=	1
B = Beam	=	54	No. of Blades	=	4
H = Draft	=	23.5	Diam. = D	=	17.083
Δ = Displacement	=	11,989	Pitch = P	=	16.02
Nominal Block Coeff	=	.80	PA ÷ DA	=	.382
M. S. Coeff	=	.985	¾ × PA ÷ DA	=	.286
H ÷ B	=	.435	T.S.	=	6,540
Type	=	2	P × R	=	1,950
B ÷ L	=	.1315	I — S	=	.792
B.C. on line C-D	=	.682	V	=	15.25
B.C. on line C.D corrected for $\frac{H}{B}$	=	.715	I.Ta.	=	3.44
Slip BC line Z	=	.823	I.H.P.	=	7,760
LAB	=	123	P.C.	=	.632
2 LAB ÷ H	=	10.45	E.H.P.	=	4,900
S = Basic Slip	=	.208	S.H.P.	=	
K.B.C.	=	.80			
K	=	1.27			

v	11.16
e.h.p.	1,480
e.h.p. ÷ E.H.P.	.302
10^{sp}	3.48
I.H.P.d	2,830
Actual I.H.P.d	2,774
v ÷ V	.732
10^{sz}	2.02
s	.153
Rd	83.8
Actual Rd	83.1

method. The resistance per ton of displacement was taken from a ship of the following dimensions: Length between perpendiculars, 380; beam, 53; draft, 24; displacement, 10,900 tons; block coefficient, 0.79; midship section coefficient, 0.988.

Problem 3.—This ship was fitted with geared turbines. Unfortunately, no torsion meter was installed, but the shaft horsepower was estimated from curves supplied by the manufacturer of the turbine. The vessel was first run on a twelve-hour trial, during which the following were the average pressures and temperatures:

Pressure at throttle	186 pounds gage
Pressure at nozzles	182 pounds gage
Superheat	Not given
Temperature at exhaust	96.3 degrees F.
Vacuum corresponding to 96.3 degrees F.	28.3
Shaft horsepower from curves	2,500

Progressive runs were then made over the Provincetown course with the following results:

Speed in knots	*Revolutions per minute*
6.355	50.075
8.055	64.05
9.511	74.00
11.447	89.37

From this the speed on the twelve-hour run was estimated to be 11.38 knots.

It will be noticed that while the revolutions per minute on the trial practically agree with the analysis, there is quite some difference in the horsepower. This might be explained

PROBLEM No. 5

Hull			Propeller		
L = L.W.L. or L.B.P.	=	331	No. of Propellers	=	1
B = Beam	=	47	No. of Blades	=	4
H = Draft	=	16.92	Diam. = D	=	14.5
Δ = Displacement	=	4,875	Pitch = P	=	14.5
Nominal Block Coeff	=	.65	PA ÷ DA	=	.40
M. S. Coeff	=	.954	¾ × PA ÷ DA	=	.30
H ÷ B	=	.36	T.S.	=	6,766
Type	=	2	P × R	=	2,150
B ÷ L	=	.142	I — S	=	.947
B.C. on line C-D	=	.565	V	=	20.3
B.C. on line C-D corrected for $\frac{H}{B}$	=	.49	I.Ta.	=	3.73
Slip BC line Z	=	.65	I.H.P.	=	6,680
LAB	=	142.75	P.C.	=	.62
2 LAB ÷ H	=	16.85	E.H.P.	=	415
S = Basic Slip	=	.053	S.H.P.	=	
K.B.C.	=	.712			
K	=	1.102			

v	12.792	12.233	11.246	9.876	7.839
e.h.p.	1,110	935	730	505	260
e.h.p. ÷ E.H.P.	.258	.225	.176	.1218	.0627
10^{sp}	4.10	4.72	6.07	9.0	17.89
I.H.P.d	1,800	1,560	1,215	819	412
Actual I.H.P.d	1,750	1,604	1,123	798	431
v ÷ V	.63	.604	.555	.486	.386
10^{sz}	3.13	3.535	4.49	6.585	12.66
s	.045	.044	.043	.043	.042
Rd	93.6	89.4	82.0	72.1	57.1
Actual Rd	95.38	92.85	82.97	74.82	58.34

PROBLEM No. 6

Hull			Propeller		
L = L.W.L. or L.B.P.	=	410.46	No. of Propellers	=	1
B = Beam	=	54	No. of Blades	=	4
H = Draft	=	24.167	Diam. = D	=	17.00
Δ = Displacement	=	12,250	Pitch = P	=	15.75
Nominal Block Coeff	=	.80	PA ÷ DA	=	.342
M. S. Coeff	=	.982	¾ × PA ÷ DA	=	.2565
H ÷ B	=	.447	T.S.	=	6,070
Type	=	2	P × R	=	1,790
B ÷ L	=	.1314	I — S	=	.785
B.C. on line C-D	=	.677	V	=	13.87
B.C. on line C-D corrected for $\frac{H}{B}$	=	.73	I.Ta.	=	2.86
Slip BC line Z	=	.833	I.H.P.	=	5,860
LAB	=	123	P.C.	=	.6575
2 LAB ÷ H	=	10.2	E.H.P.	=	3,850
S = Basic Slip	=	.215	S.H.P.	=	
K.B.C.	=	.796			
K	=	1.26			

v	9.385	8.952	7.007	5.615
Actual I.H.P.d	2,088	1,700	914	561.5
v ÷ V	.676	.645	.505	.405
10^{sz}	2.56	2.92	5.88	11.00
s	.196	.182	.197	.227
Rd	75.0	70.5	56.2	46.7
Actual Rd	74.57	70.38	55.98	46.83
e.h.p.d ÷ E.H.P.	.318	.27	.131	.08
10^{sl}	3.30	3.92	8.35	13.98
$10^{spq} = \sqrt{\frac{\text{I.H.P.} \times 10^{sl}}{\text{I.H.P.d}}}$	3.04	3.675	7.32	12.08
$10^{sp} = 10^{spq} \times K$	3.83	4.63	9.23	15.22
e.h.p. ÷ E.H.P.	.2755	.229	.118	.073
e.h.p. = E.H.P. × (e.h.p. ÷ E.H.P.)	1,060	882	455	281
e.h.p. Model 1013	898	787	406	220

PROBLEM No. 7

Hull			Propeller		
L = L.W.L. or L.B.P.	=	415	No. of Propellers	=	1
B = Beam	=	56	No. of Blades	=	4
H = Draft	=	25.5	Diam. = D	=	17.75
Δ Displacement	=	13,573	Pitch = P	=	17.5
Nominal Block Coeff	=	.806	PA ÷ DA	=	.375
M. S. Coeff	=	.973	¾ × PA ÷ DA	=	.281
H ÷ B	=	.455	T.S.	=	6,450
Type	=	2	P × R	=	2,025
B ÷ L	=	.135	I — S	=	.87
B.C. on line C-D	=	.694	V	=	17.4
B.C. on line C-D corrected for $\frac{H}{B}$	=	.76	I.Ta.	=	3.32
Slip BC line Z	=	.853	I.H.P.	=	8,400
LAB	=	148	P.C.	=	.637
2 LAB ÷ H	=	11.6	E.H.P.	=	5,350
S = Basic Slip	=	.13	S.H.P.	=	
K.B.C.	=	.808			
K	=	1.29			

v	11.322	10.934	11.375	10.868	11.405	9.905
v ÷ V	.652	.629	.654	.625	.656	.57
10^{sz}	2.832	3.144	2.804	3.20	2.778	4.17
Actual I.H.P.d	2,706	2,601	2,756	2,510	2,886	1,997
s.	.119	.127	.120	.124	.124	.127
Rd	74.4	72.5	74.6	71.6	75.3	65.8
Actual Rd	75.2	72.46	74.2	71.55	74.07	64.85
$10^{sp} = \frac{\text{I.H.P.} \times K}{\text{I.H.P.d}}$	4.00	4.16	3.935	4.31	3.755	5.425
e.h.p. ÷ E.H.P.	.264	.2545	.2685	.246	.281	.197
e.h.p. = E.H.P. × (e.h.p. ÷ E.H.P.)	1,423	1,362	1,437	1,317	1,504	1,053
Estimated e.h.p.	1,450	1,280	1,480	1,260	1,490	940

by the fact that, the propeller being a cast iron wheel, the roughness of its surface added at least 2 to 3 percent to the power, while the remainder may be due to a slight inaccu-

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PROBLEM No. 8

Hull			Propeller		
L = L.W.L. or L.B.P.	=	520	No. of Propellers	=	2
B = Beam	=	65.23	No. of Blades	=	3
H = Draft	=	27.75	Diam. = D	=	15.954
Δ = Displacement	=	19,452	Pitch = P	=	14.422
Nominal Block Coeff	=	.725	PA ÷ DA	=	.304
M.S. Coeff	=	.984			
H ÷ B	=	.425	T.S.	=	6,850
Type	=	2	P × R	=	1,972
B ÷ L	=	.125	I — S	=	.805
B.C. on line C-D	=	.593	V	=	15.67
			I.Td	=	3.8
B.C. on line C-D corrected for H/B	=	.60	IHP	=	13,100
Slip BC line X	=	.625	P.C.	=	.678
LAB Estimated	=	183	E.H.P.	=	8,870
2 LAB ÷ H	=	13.2	S.H.P.	=	12,050
S = Basic Slip	=	.195			
K.B.C.	=	.618			
K	=	1.2			

v	14.99	14.00
e.h.p.	4,420	3,550
e.h.p. ÷ E.H.P.	.498	.40
10^{sp}	2.06	2.59
S.H.Pd	7,030	5,580
Actual S.H.Pd	7,150	5,460
v ÷ V	.957	.894
10^{ss}	1.0	1.134
s	.114	.102
Rd	118.8	109.5
Actual Rd	116.72	108.5

PROBLEM No. 9

Hull			Propeller		
L = L.W.L. or L.B.P.	=	528	No. of Propellers	=	2
B = Beam	=	62.23	No. of Blades	=	3
H = Draft	=	27.35	Diam. = D	=	16.5
Δ = Displacement	=	18,700	Pitch = P	=	.18
Nominal Block Coeff	=	.726	PA ÷ DA	=	.278
M.S. Coeff	=	.984			
H ÷ B	=	.44	T.S.	=	6,410
Type	=	2	P × R	=	2,225
B ÷ L	=	.118	I — S	=	.82
B.C. on line C-D	=	.579	V	=	18.0
B.C. on line C-D corrected for H/B	=	.61	I.Td	=	3.29
Slip BC line X	=	.635	I.H.P.	=	13,680
LAB	=	184	P.C.	=	.691
2 LAB ÷ H	=	13.45	E.H.P.	=	9,450
S = Basic Slip	=	.18	S.H.P.	=	
K.B.C.	=	.605			
K	=	1.188			

v	15.5
e.h.p.	5,130
e.h.p. ÷ E.H.P.	.543
10^{sp}	1.886
I.H.Pd	8,620
Actual I.H.Pd	8,400
v ÷ V	.862
10^{ss}	1.278
s	.145
Rd	102
Actual Rd	98.2

PROBLEM No. 10

Hull			Propeller		
L = L.W.L. or L.B.P.	=	522	No. of Propellers	=	2
B = Beam	=	62	No. of Blades	=	3
H = Draft	=	19.4	Diam. = D	=	16.5
Δ = Displacement	=	12,000	Pitch = P	=	16.167
Nominal Block Coeff	=	.671	PA ÷ DA	=	.30
M. S. Coeff	=	.992	T.S.	=	6,766
H ÷ B	=	.313			
Type	=	2	P × R	=	2,107
B ÷ L	=	.119	I — S	=	.834
B.C. on line C-D	=	.533	V	=	17.33
B.C. on line C-D corrected for H/B	=	.42	I.Td	=	3.73
Slip BC line X	=	.455	I.H.P.	=	14,680
LAB	=	208	P.C.	=	.68
2 LAB ÷ H	=	21.5	E.H.P.	=	10,000
S = Basic Slip	=	.166	S.H.P.	=	
K.B.C.	=	.562			
K	=	1.145			

v	14.79
e.h.p.	3,700
e.h.p. ÷ E.H.P.	.37
10^{sp}	2.82
IHPd	5,960
IHPd on trial estimated	6,540
v ÷ V	.854
10^{ss}	1.305
s	.088
Rd	101.8
Actual Rd	104.75

racy of the gages and thermometer or a difference between the superheat obtained on this trial and that for which the curves were drawn.

Problem 4.—As there was no measured mile within reasonable distance, the run was made from Ambrose Light Ship to Fire Island Light Ship and return. The revolutions were held as near constant as was possible, and indicator cards were taken every fifteen minutes. While the results are not as accurate as if the run had been made over a measured mile, it is believed they are sufficiently accurate to warrant presenting them in this paper. There was a very slight swell and a breeze of not over 3 knots during the trial.

Problem 5.—The data for this problem were taken from "Notes on the Performance of S. S. *Tyler*," by Mr. E. H. Rigg, published in Vol. XX of the transactions of this society. The data given as actual indicated horsepower and R_d are those observed on the trial runs. If those of the faired curves had been given, the actual indicated horsepower for 12.233 knots would have been 1,480 and the actual R_d would have been 90.8 and for 9.876 knots the actual indicated horsepower and R_d would have been 790 and 73.2.

Problem 6.—The power and revolutions as given by an analysis did not agree with those obtained on the trial. As the difference was so great, an investigation was made as to the causes. It was found that the wheel was working in cavitation and the effective horsepowers were greater than those shown on the curves. An analysis was made for revolutions (using the indicated horsepower from the trials), which check with those obtained on the runs. The effective horsepowers were then calculated and compared with those of Model 1013, the block and midship section coefficient and dimensions of which are the same as this ship. The length of after body was the same, while the middle body of Model 1013 was slightly less and the fore body slightly longer. The forward sections of the ship were more of the U shape, and the after sections had more of a club foot than the model. According to experiments conducted by Professors H. C. Sadler and E. M. Bragg, the results of which were published in last year's transactions, it would appear that Model 1013 would require slightly less power for these low speeds. This would only partly account for the difference; the remainder would probably be caused by the condition of the ship's bottom. The vessel was drydocked and then loaded, after which the trial was run. The time between drydocking and the trial was about three weeks.

Problem 7.—The results of the trials at two speeds of three ships of the same design, together with the analysis, are given in this problem. No effective horsepower curves were available. The revolutions were calculated using the indicated horsepower. The effective horsepower was then calculated and compared with that estimated.

GROUP 2

We will now pass to the second group; namely, ships fitted with more than one screw, the shafts of the wing propellers being carried in struts. The first two, Problems 8 and 9, are the navy colliers *Jupiter* and *Cyclops*. While these are not merchant ships, their forms are very similar to moderate speed freighters or to slow speed passenger and cargo ships and are included in this paper for lack of other available data.

Problem 8.—As the writer was not in possession of the length of after body of this ship, an estimate was made using that of the *Cyclops* (Problem 9).

Problem 10.—This ship had been in the water for some time before the trial, which accounts for the difference in horsepower between the estimate and that obtained on the trial. Unfortunately indicator cards were not taken on the mile run, but were taken after the same. The average power was 6,155 and average revolutions 102.75. Assuming the power to vary as the cube of the revolutions we have $6{,}155 \times \left(\frac{104.75}{102.75}\right)^3 = 6{,}540$, which is used as the indicated horsepower on the mile course. If this figure (6,540) was used in the calculations for slip in place of the estimated power, R_d would have been 102.8 in place of 101.8.

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PROBLEM No. 11 (A)

Hull		Propeller	
L = L.W.L. or L.B.P.	= 530	No. of Propellers	= 2
B = Beam	= 72	No. of Blades	= 3
H = Draft	= 24	Diam. = D	= 17.00
Δ = Displacement	= 16,013	Pitch = P	= 18.50
Nominal Block Coeff.	= .612	PA ÷ DA	= .315
M. S. Coeff.	= .982		
H ÷ B	= .334	T.S.	= 7,020
Type	= 2	P × R	= 2,430
B ÷ L	= .136	I — S	= .86
B.C. on line C-D	= .526	V	= 20.60
B.C. on line C-D corrected for H/B	= .451	I.Ta.	= 4.02
Slip BC line X	= .485	I.H.P.	= 19,350
LAB	= .250	P.C.	= .673
2 LAB ÷ H	= 21.2	E.H.P.	= 13,020
S = Basic Slip	= .14	S.H.P.	= 17,810
K.B.C.	= .552		
K	= 1.12		

v	20	19	18	16	14	12
e.h.p.	9,875	7,950	6,700	4,700	3,125	1,950
e.h.p. ÷ E.H.P.	.758	.611	.515	.361	.2405	.1497
10^{sp}	1.335	1.67	1.994	2.89	4.415	7.22
SHPd	14,950	11,950	10,000	6,900	4,520	2,760
Actual SHPd	14,950	11,900	9,855	6,800	4,525	2,850
v ÷ V	.971	.922	.874	.777	.68	.582
10^{ss}	1.0	1.04	1.214	1.711	2.52	3.93
s	.118	.098	.095	.093	.089	.085
Rd	122.7	115.4	109	96.6	84.2	71.8
Actual Rd	122	115	109	96	83.5	71

PROBLEM No. 11 (B)

Hull		Propeller	
L = L.W.L. or L.B.P.	= 535	No. of Propellers	= 2
B = Beam	= 72	No. of Blades	= 3
H = Draft	= 30	Diam. = D	= 17.0
Δ = Displacement	= 20,800	Pitch = P	= 18.5
Nominal Block Coeff.	= .63	PA ÷ DA	= .315
M. S. Coeff.	= .987		
H ÷ B	= .417	T.S.	= 7,020
Type	= 2	P × R	= 2,430
B ÷ L	= .1345	I — S	= .855
B.C. on line C-D	= .534	V	= 20.52
B.C. on line C-D corrected for H/B	= .528	I.Ta.	= 4.02
Slip BC line X	= .558	I.H.P.	= 19,350
LAB	= .255	P.C.	= .673
2 LAB ÷ H	= 17	E.H.P.	= 13,020
S = Basic Slip	= .145	S.H.P.	= 17,810
K.B.C.	= .563		
K	= 1.14		

v	19	18	16	14	12
e.h.p.	9,475	8,000	5,600	3,675	2,275
e.h.p. ÷ E.H.P.	.728	.615	.43	.282	.1745
10^{sp}	1.393	1.659	2.405	3.74	6.16
SHPd	14,500	12,250	8,450	5,430	3,300
Actual SHPd	14,500	12,100	8,400	5,500	3,350
v ÷ V	.926	.8775	.78	.683	.585
10^{ss}	1.029	1.2	1.69	2.48	3.87
s	.122	.12	.116	.110	.104
Rd	118.7	112.2	99.2	86.1	73.3
Actual Rd	119.5	113	99.5	86.5	73.5

PROBLEM No. 11 (C)

Hull		Propeller	
L = L.W.L. or L.B.P.	= 535	No. of Propellers	= 2
B = Beam	= 72	No. of Blades	= 3
H = Draft	= 36	Diam. = D	= 17
Δ = Displacement	= 25,863	Pitch = P	= 18.5
Nominal Block Coeff.	= .652	PA ÷ DA	= .315
M. S. Coeff.	= .989		
H ÷ B	= .5	T.S.	= 7,020
Type	= 2	P × R	= 2,430
B ÷ L	= .1345	I — S	= .867
B.C. on line C-D	= .553	V	= 20.8
B.C. on line C-D corrected for H/B	= .645	I.Ta.	= 4.02
Slip BC line X	= .667	I.H.P.	= 19,350
LAB	= .255	P.C.	= .673
2 LAB ÷ H	= 14.17	E.H.P.	= 13,020
S = Basic Slip	= .133	S.H.P.	= 17,810
K.B.C.	= .576		
K	= 1.16		

v	19	18	16	14	12
e.h.p.	11,200	9,350	6,375	4,125	2,550
e.h.p. ÷ E.H.P.	.86	.718	.49	.317	.197
10^{sp}	1.17	1.413	2.098	3.32	5.47
SHPd	17,670	14,620	9,860	6,230	3,780
Actual SHPd	17,650	14,700	10,050	6,500	4,075
v ÷ V	.913	.865	.769	.673	.577
10^{ss}	1.066	1.25	1.766	2.59	4.02
s	.141	.137	.130	.121	.117
Rd	121.2	114.3	100.8	87.3	74.5
Actual Rd	124	117	103	89.5	76

GROUP 3

When the wing shafts are carried in bosses, the basic slip seems to be affected if the bosses are horizontal or nearly so, as will be shown in Problem 12.

Problem 11.—Unfortunately, no trials were run on these ships at the designed deep draft of 30 feet. The model was

PROBLEM No. 11 (D)

Hull		Propeller	
L = L.W.L. or L.B.P.	= 530	No. of Propellers	= 2
B = Beam	= 72	No. of Blades	= 3
H = Draft	= 24	Diam. = D	= 16.5
Δ = Displacement	= 16,013	Pitch = P	= 17.0
Nominal Block Coeff.	= .612	PA ÷ DA	= .325
M. S. Coeff.	= .983		
H ÷ B	= .334	T.S.	= 7,210
Type	= 2	P × R	= 2,365
B ÷ L	= .136	I — S	= .86
B.C. on line C-D	= .526	V	= 20.05
B.C. on line C-D corrected for H/B	= .451	I.Ta.	= 4.25
Slip BC line X	= .485	I.H.P.	= 18,750
LAB	= .250	P.C.	= .667
2 LAB ÷ H	= 21.2	E.H.P.	= 12,500
S = Basic Slip	= .14	S.H.P.	= 17,250
K.B.C.	= .552		
K	= 1.12		

v	19	18	16	14	12
e.h.p.	7,950	6,700	4,700	3,125	1,950
e.h.p. ÷ E.H.P.	.636	.536	.376	.25	.156
10^{sp}	1.602	1.914	2.775	4.23	6.95
SHPd	12,050	10,080	6,960	4,570	2,780
Actual SHPd	13,400	11,370	7,820	5,000	3,120
v ÷ V	.948	.898	.798	.699	.599
10^{ss}	1.0	1.121	1.588	2.32	3.616
s	.098	.092	.09	.086	.081
Rd	125.5	118	104.7	91.3	77.8
Actual Rd	126.4	119.7	105.7	91	79

PROBLEM No. 12

Hull		Propeller	
L = L.W.L or L.B.P.	= 663	No. of Propellers	= 2
B = Beam	= 67	No. of Blades	= 4
H = Draft	= 29	Diam. = D	= 22.32
Δ = Displacement	= 23,300	Pitch = P	= 34.44
Nominal Block Coeff.	= .634	PA ÷ DA	= .2625
M. S. Coeff.	= .943	¾ × PA ÷ DA	= .197
H ÷ B	= .433	T.S.	= 5,160
Type	= 2	P × R	= 2,535
B ÷ L	= .101	I — S	= .933
B.C. on line C-D	= .462	V	= 23.3
B.C. on line C-D corrected for H/B	= .47	I.Ta.	= 1.8
Slip BC line... Line X = .506 / Line Y = .532	= .519	I.H.P.	= 18,800
LAB	= 331	P.C.	= .697
2 LAB ÷ H	= 22.8	E.H.P.	= 13,100
S = Basic Slip	= .067	S.H.P.	=
K.B.C. Line X = .496 / Line Y = .526	= .511		
K	= 1.10		

v	23.5
Actual IHP	36,000
v ÷ V	1.008
10^{ss}	1.00
s	.128
Rd	79.8
Actual Rd	79.5

Estimated W.S. = 61,000 sq. ft.

B ÷ H = 2.31; Pris. Coeff. = .672

$$\Delta \div \left(\frac{LWL}{100}\right)^3 = 80;$$

$$v \div \sqrt{LWL} = .912$$

$$10^{sp} = \frac{IHP \times K}{IHPd} = 5.75$$

e.h.p. ÷ E.H.P. = 1.70

$$\text{e.h.p.} = \text{E.H.P.} \times \frac{\text{e.h.p.}}{\text{E.H.P.}} = 22{,}300$$

Estimated e.h.p. = 24,057

Es = .00307 × .009 × 61,000 × 7,588 = 12,800

Er = .00307 × 23,300 × 5.4 × 23.5 = 9,070

e.h.p. Bare Hull = 21,870

e.h.p. with App. = 21,870 × 1.1 = 24,057

Note—Draft on trial not known.

PROBLEM No. 13

Hull		Propeller	
L = L.W.L. or L.B.P.	= 439.5	No. of Propellers	= 2
B = Beam	= 60	No. of Blades	= 4
H = Draft	= 24	Diam. = D	= 13.5
Δ = Displacement	= 14,250	Pitch = P	= 11.75
Nominal Block Coeff.	= .787	PA ÷ DA	= .357
M. S. Coeff.	=	¾ × PA ÷ DA	= .268
H ÷ B	= .40	T.S.	= 6,260
Type	= 2	P × R	= 1,735
B ÷ L	= .1365	I — S	= .858
B.C. on line C-D	= .677	V	= 14.68
B.C. on line C-D corrected for H/B	= .65	I.Ta.	= 3.08
Slip BC line ... X = .67 / Y = .698	= .684	I.H.P.	= 7,710
LAB	= 162.5	P.C.	= .648
2 LAB ÷ H	= 13.55	E.H.P.	= 5,000
S = Basic Slip	= .142	S.H.P.	= 7,090
K.B.C. Line X = .696 / Line Y = .722	= .709		
K	= 1.37		

v	11.64
e.h.p. Estimated	1,695
e.h.p. ÷ E.H.P.	.339
10^{sp}	3.09
SHPd	3,140
Estimated SHP = IHPd × .75	3,160
v ÷ V	.794
10^{ss}	1.61
Rd	113
Actual	109.92

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PROBLEM NO. 14

Hull			Propeller		Wing	Centre
L = L.W.L or L.B.P	=	500	No. of Propellers	=	2	1
B = Beam	=	63	No. of Blades	=	3	3
H = Draft	=	20.458	Diam. = D	=	9.167	9.167
Δ = Displacement	=	9,612	Pitch = P	=	8.346	8.346
Nominal Block Coeff.	=	.522	PA ÷ DA	=	.516	.516
M. S. Coeff. About	=	.935				
H ÷ B	=	.325	T.S.	=	11,040	11,040
Type	=	3	P × R	=	3,200	3,200
B ÷ L	=	.126	I — S	=	.828	.888
B.C. on line A-B	=	.388	V	=	26.2	28.1
B.C. on line A-B corrected for $\frac{H}{B}$	=	.375	I.Td.	=	9.23	9.23
	Wing	Centre	I.H.P. each	=	8,500	8,500
Slip BC line. { X for Wing / W for Centre }	= .474	.530				
LAB Estimated	=	200	P.C.	=	.546	.546
2 LAB ÷ H	=	19.55	E.H.P.	=	4.645	4,645
S = Basic Slip	= .172	.112	S.H.P.	=	7,810	7,810
K.B.C. { Line X for Wing / Line W for Centre }	= .485	.542				
K	= 1.0	1.12				

v	23.99		23.194		21.088		18.839		16.541	
	Wing	Centre	Wing	Centre	Wing	Centre	Wing	Centre	Wing	Centre
v ÷ V	.916	.855	.885	.825	.805	.751	.72	.671	.631	.59
10^{xs}	1.06	1.3	1.17	1.44	1.54	1.89	2.125	2.61	3.116	3.775
Actual SHPd each	8,899	7,767	7,525	6,925	5,048	4,995	3,495	3,705	2,008	2,199
s	.208	.145	.194	.143	.172	.135	.164	.139	.138	.119
Rd	368	340	349	328.5	309.5	297	274	266	233.5	228
Actual Rd	367	338.7	349.8	326.6	310.9	294.4	276.1	264.9	234.4	233.4
$10^{xp} = \frac{SHP \times K}{SHPd}$	.878	1.125	1.039	1.263	1.548	1.735	2.235	2.36	3.89	3.98
e.h.p ÷ E.H.P.	1.133	.893	.964	.80	.657	.588	.461	.438	.2715	.2655
e.h.p. for each screw	5,260	4,145	4,470	3,715	3,055	2,730	2,140	2,035	2,160	1,232
Total e.h.p. = 2 wing + center	14,665		12,655		8,840		6,315		3,752	
e.h.p. Bare Hull	12,420		10,975		8,250		5,790		3,520	
Total e.h.p. ÷ e.h.p. B.H.	1.18		1.153		1.07		1.091		1.066	

tested at three drafts with model propellers. While the powers check very closely in all three cases, the estimated revolutions at 36-foot draft do not agree with those obtained from the model test. As this draft (36 feet) is four times the height of the center of propeller above the base line, this might be considered as a deep-draft vessel with propellers carried as deeply as possible, which condition is not covered in Admiral Dyson's latest work. A correction should be made for obtaining the basic slip. The writer is not prepared to say just how this should be made, but two ways are possible; first, taking the slip block coefficient and basic slip at a lighter draft, or second, by using a line on the block coefficient chart passing through the lower left-hand corner of the chart and cutting the right-hand side somewhere above line *X*. The slip block coefficient would then be less and the basic slip greater than what it would be by using line *X*.

A trial was run on a ship similar to this but fitted with different propellers. It will be noticed that, while the revolutions agree, there is some difference in the power. This was caused by the run being made on the Delaware Breakwater Course. The lack of deep water affects the power but does not seem to vary the revolutions for given speeds. This was shown by tests conducted by the United States Navy on the battleship *Michigan,* which was run over the Rockland, Provincetown and Delaware Breakwater courses. While the revolutions for various speeds were practically the same on all the courses, the power varied considerably. As the draft and range of speed of the two ships are practically the same, it would be safe to consider that, had this ship been tested in deep water, the power developed would have been very close to that estimated, while the revolutions would be the same as those obtained on this trial.

The propeller shafts of both model and ship were carried in bosses set at about 32 degrees with the horizontal plane, the intersection of which with the hull was probably parallel or nearly parallel with the stream lines.

Problem 12.—The angle between the bosses and the horizontal plane on this ship was about 10 to 15 degrees which, as will be seen in the calculation, seems to affect the basic slip. The revolutions were first calculated using the value for slip block coefficient as given on line *X*, then using line *Y*. In the former case the calculated revolutions were greater and in the latter they were less than those obtained on the trial. By using a value between these two, the calculated R_d worked out almost the same as the actual R_d. On account of lack of data, the value of *K* cannot be determined, but an estimate was made of the effective horsepower by the Taylor method and by calculation from the propeller data. There was quite some difference between these, which would be accounted for if the draft during the trial (which is not known) was less than 29 feet.

Problem 13.—For the same reason as mentioned in Problem 4, this ship was run from Ambrose Light Ship to Fire Island Light Ship and return. Unfortunately, the only effective horsepower curve available was for a draft of 28 feet 2 inches. Assuming the effective horsepower to vary as a means of the ratios of the displacements and the displacements to the two-third power, we have:

Displacement at 28 feet 2 inches	16,900
Displacement at 24 feet 0 inches	14,250
$(14,250 \div 16,900)^{2/3}$	0.894
14,250 ÷ 16,900	.844
Mean	.869

Effective horsepower (28-foot 2-inch draft) at 11.64 knots = 1,860
Effective horsepower (24-foot draft) at 11.64 knots = 1,860 × 0.869 = 1,615.

The above powers included the resistance of the rudder and bilge keels but not the propeller bosses, which is estimated at 80, making a total effective horsepower of 1,695. This vessel was fitted with Diesel engines, the mechanical efficiency of which was about 75 percent.

The angle of the bosses with the horizontal plane was about 20 degrees.

Problem 14—This ship is the *Great Northern,* the trial-trip data of which were published in the *Journal of the American Society of Naval Engineers.* The values of effective horsepower, which were obtained by multiplying the shaft horsepower by the propulsive coefficients as shown on the trial curves, are probably that for the bare hull, as the propulsive coefficients are quite low and as the propellers are apparently out of cavitation. The revolutions were calculated using the shaft horsepower from the trial data, and compared with the actual revolutions. Calculations were

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then made for the effective horsepower. The difference between the calculated effective horsepower and those obtained by multiplying the shaft horsepower by the propulsive coefficients could be taken as the power required for the appendages.

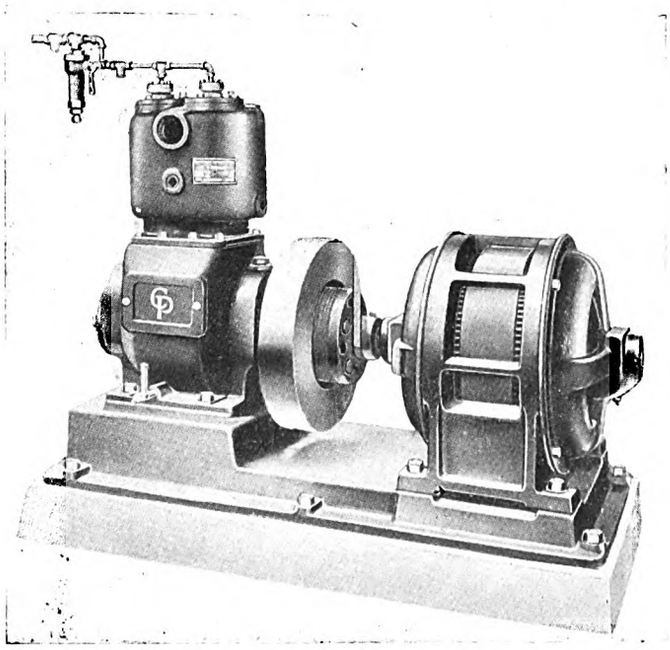
Conclusion

In the foregoing are represented almost every type of seagoing merchant ships. Problems 1 to 7 are single screw ships and, with the exception of Problem 5, have full lines, the block coefficients being over 0.77. Problem 13 is a full-bodied cargo ship with twin screws. Problems 8, 9 and 10 are of the slow cargo and passenger type or moderate speed freighter, fitted with twin screws. Problem 11 is a moderate speed cargo and passenger ship, while Problems 12 and 14 represent high speed passenger vessels. The vessel in Problem 5 was built for the coast trade between New York and Norfolk. When loaded to her deep draft (about 22 feet) her underwater body was similar to a moderate speed cargo and passenger vessel with single screw. At the draft at which the trial was run (16 feet 11 inches), the underwater body was more like a sound or river steamer with a full midship section.

The writer regrets that he had to include in this paper examples where either very accurate or full information was not obtainable, but was obliged to do so because of the lack of more complete data.

Flexible Couplings Make Direct Motor Drive Compressors Possible

Because of the demand for a small air compressor which could be directly connected to an electric motor, the Chicago Pneumatic Tool Company, Chicago, Ill., has recently developed a line of high speed compressors which can be directly connected to either electric motors or internal combustion engines by means of flexible couplings. The compressors are of the vertical, duplex, single acting, water-cooled type fitted with "Simplate" flat disk inlet and discharge valves. The straight and uniform lift of these valves affords a maximum effective valve area which makes possible the speed at which these compressors operate.



Small Air Compressor Directly Coupled to Electric Motor Through Flexible Coupling

The machines are built in three sizes having piston displacements of 128, 160 and 210 cubic feet of air per minute and are suitable for working pressures of 150 pounds per square inch. The standard speed of these sizes is 600 revolutions per minute.

The equipment includes a hand starter for the motor and an inlet valve unloader for the compressor. Where the demand for air is intermittent the motor can be furnished with an automatic starter which starts and stops the unit within pre-determined pressure limits. When this type of starter is used the compressor is equipped with a centrifugal unloader which automatically relieves the compressor of its load while the motor is starting up or shutting down. A water control valve is also furnished which is operated by air pressure governed by a centrifugal unloader. Since the lubrication is accomplished by a combination pump and splash system the entire unit is automatic as the electric current, air delivery, circulating water and lubrication are all accurately controlled automatically.

New Italian Liner.—The Navigazione Generale Italiana announces that they have now in the course of construction a new passenger vessel, the *Duilio* which is to be a sister ship of the *Giulio Cesare*, of 21,500 tons.

(Photograph, Kadel & Herbert, N. Y.)

Uncle Sam's Lightships No Longer Out of Touch with the World

Uncle Sam has now equipped his lightships with the very latest and most modern radio equipment. The lightships can transmit and hold conversations with incoming ships to determine their positions at sea, also broadcasting fog and danger signals. The loneliness of the personnel of the lightships is now solved by the latest radio equipment which is installed under the direction of the Lighthouse Service in Washington which will enable the lightship keeper to tune in on concerts, lectures, etc. The above photograph shows the radio compass of the lightship at Ambrose Channel with first officer George H. Peterson seen tuning in. Note the receiving set on the right which consists of detector and six stages of audio frequency amplification.

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The Current Actuated or Flettner Rudder*

Every rudder in a certain sense is current actuated since rudder pressure is only developed by a current. The new rudder described in this article also derives from the current the forces necessary for setting the rudder itself, constituting a fundamental departure from the time-honored arrangement of ships' rudders. The forces required for holding the rudder of a large ship against the current are very great, necessitating powerful steering engines to develop the turning moment necessary to rotate the rudder stock. By using the current actuated rudder the necessity for such great forces may be avoided and large ships may be steered by hand.

THE first practical application on a ship of the Flettner or current actuated rudder was made on the steamship *Frigido*, following several years of investigation with models and after a series of trials had been conducted upon a motorship. This experimental motorship was fitted with a current actuated rudder early in 1920 in order to test the practicability of the device, particularly in going astern. The scheme of using an auxiliary rudder at the after end of the main rudder for the purpose of developing side pressures for setting the main rudder was first applied in large German battle planes, several hundred of which were fitted with this appliance.

Before going into the details of the rudder, a few remarks are necessary to point out the elementary principles upon which the rudder depends.

Principles Affecting Rudder Action

Let us assume a ship in which a standpipe is fitted in connection with the water outside through a small pipe (Fig. 1). With the ship in motion, the water in the standpipe sinks to a new level depending upon the velocity. This principle has been used in a well known type of speed measuring device.

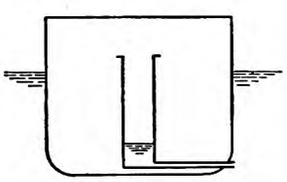

Fig. 1

As another example, Fig. 2 shows a canal in which the water is motionless. As soon as the water is put in motion, the level in the standpipe (Fig. 3) drops. The height of water remaining in the tube (p) indicates the pressure existing in the stream at the orifice of the tube. The difference between the level in the tube and the level outside represents the loss in potential energy and the gain in kinetic energy in the moving liquid. This difference in level is a measure of

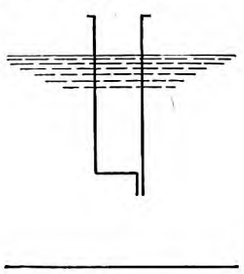

Fig. 2

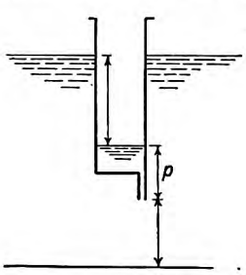

Fig. 3

the kinetic energy in the liquid and where the velocity is v, the kinetic energy equals $\frac{v^2}{2g}$ (for metric units). If the loss in pressure is known, the velocity of the stream may be calculated.

If we explore the surfaces of a rudder which is set at an angle to the current and plot the pressures we will obtain a diagram similar to Fig. 4, where we find upon the one side

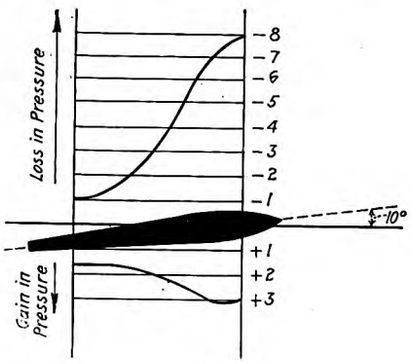

Fig. 4

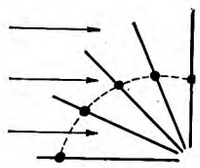

Fig. 5

of the rudder a loss in pressure and upon the other side a gain in pressure. Furthermore, this loss or gain is not uniform over the length of the rudder but in general is greatest

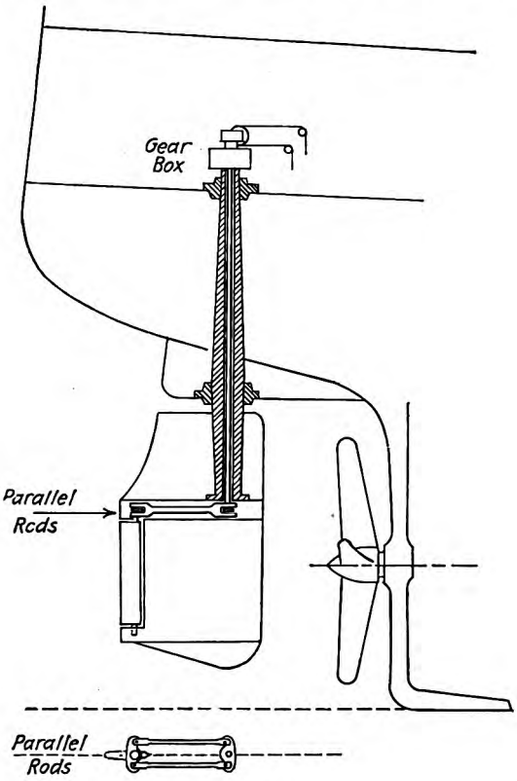

Fig. 6

near the leading edge. As a consequence of the unequal distribution of the pressure, the center of pressure is near the leading edge for small angles. For an angle of 90 degrees

*Abridged translation by Lieutenant E. L. Gayhart, C. C., U. S. N., of an article by Anton Flettner, Director of the Flettner Scheepswerf-Maatschappij Rotterdam-Berlin, appearing in Werft-Reederei-Hafen of August 22, 1922.

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to the current the center of pressure moves to the center of the area, and for intermediate angles the motion is about as indicated in Fig. 5.

Current Actuated Rudder

The principle underlying the current actuated rudder is the development of a difference in pressure at the after edge of the rudder, which difference in pressure shall have a determined direction. Fig. 6 is a schematic representation of the new rudder arranged as an underhung rudder, while Fig. 7 represents the form as installed on the *Frigido*.

Figs. 8 and 9 represent diagrammatically the plan view of the rudder when going respectively ahead and astern. In

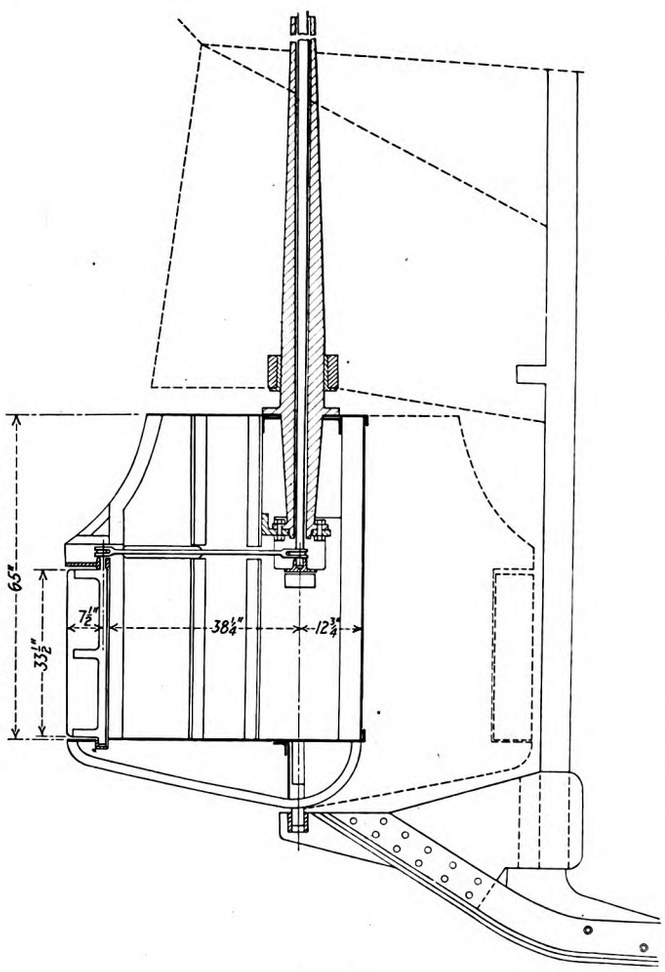

Fig. 7

these views, the positive and negative signs represent excess and diminished pressure and the number and distribution of these signs show the relative values of these pressures. When, as here shown, the auxiliary rudder is turned, a reduction in pressure occurs at the convex side of the angle in the vicinity of the auxiliary rudder with a feeble increase in pressure on the opposite side. If the auxiliary rudder had not been turned, the location of the center of pressure somewhat abaft the axis would have resulted in bringing the main rudder back to the midships position. But with the auxiliary rudder set as shown in the diagram, a certain pressure difference is developed at the after edge of the main rudder and the combined center of pressure of the system moves to the axis. The rudder then hangs in equilibrium as shown.

Mathematically, we might consider the system as a lever where the force P acting on the arm x is balanced by the force $P/20$ acting on an arm $20x$. This ratio of 1:20 is assumed for example; actually, it may be made even more favorable by appropriate design.

Fig. 10 represents a ship with rudder of ordinary type at the moment of meeting the ship with the rudder when

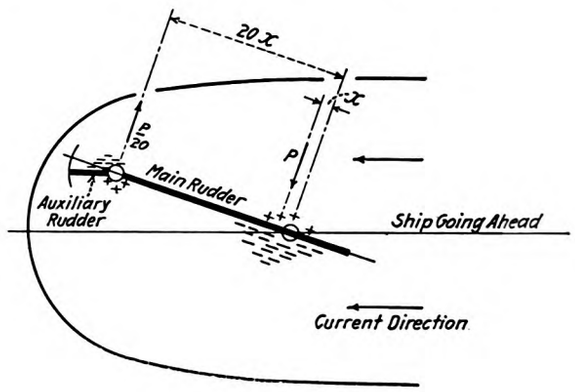

Fig. 8

straightening out from a turn. The current momentarily strikes the rudder at an angle of between 80 and 90 degrees. The center of pressure is near the middle of the rudder and, in consequence, the forces acting on the rudder are ex-

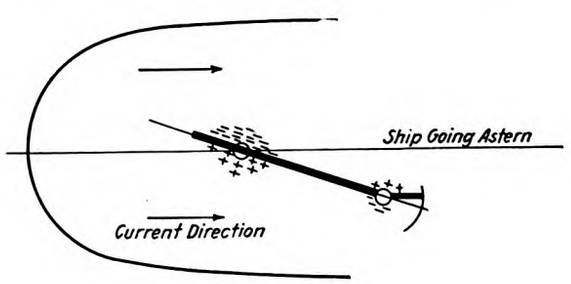

Fig. 9

cessive and the position of the rudder to the current is unfavorable for developing a turning effect on the ship.

The current actuated rudder can never be placed in such an unfavorable position relative to the current since it adjusts itself with respect to the effective direction of the current,

Fig. 10

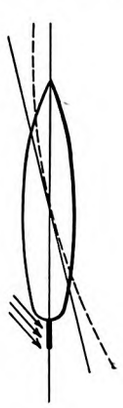

Fig. 11

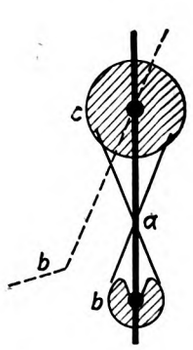

Fig. 12

which, in the situation just mentioned, does not correspond with the ship's head. When the helmsman puts his wheel hard over to check the ship's head, the current actuated rudder will not take that actual position but rather will hang momentarily near the fore and aft direction as indicated in Fig. 11. In this apparently unfavorable position the current strikes the rudder at a much better angle for developing turn-

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ing effect on the ship than is the case with the normal rudder when put hard over too soon. Experience has demonstrated that the turning of the ship from one direction to another takes place with surprising rapidity.

Control Mechanisim

The control mechanism for this rudder may be represented by the arrangement shown in Fig. 12. Here, *a* represents the main rudder, *b* the auxiliary rudder, and *c* a pulley capable of rotation about the axis of *a*. Suppose that *c* is turned through 15 degrees. Then the auxiliary rudder will be turned in such a direction that its effect on the main rudder will be to cause the latter to follow the motion of *c*. But as the main rudder swings to follow *c*, the auxiliary rudder is turned back toward the neutral position. This arrangement is but another example of the familiar follow-up gear. The main rudder, because of the restoring of the position of the auxiliary rudder by the follow-up action, will not move as far as *c* is displaced but will reach a point where there is equilibrium between the forces on the two rudders.

Now suppose that the pulley *c* is held while the main rudder is forcibly displaced. The action of the mechanism is such as to swing the auxiliary rudder in the same direction and with greater velocity. The effect is shown by the dotted line in Fig. 12. It will be seen that the auxiliary rudder acts to oppose any undesired disturbance of the main rudder, and furnishes an automatic control over the position of the main rudder.

The actual mechanism used for operating the rudder is shown in Figs. 13 and 14. This system of gearing replaces

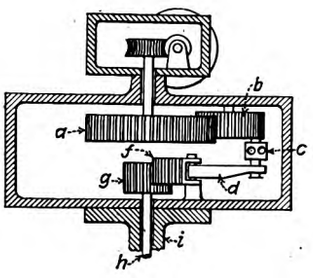

Fig. 13

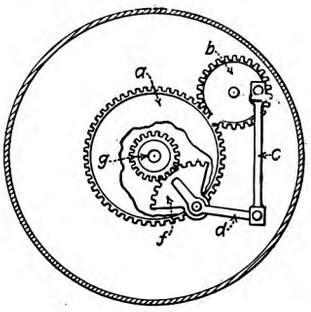

Fig. 14

the simple arrangement shown in Fig. 12. The operation of the rudder from the bridge is effected by hand, even with large ships. A cable leads from the steering wheel on the bridge to the so-called upper box which contains a worm and worm wheel. The gear wheel *a* is the main direction element and corresponds to the pulley *c* of Fig. 12. If this gear is turned, it acts to turn the operating shaft of the auxiliary rudder through the arrangement of gears and levers shown. The main gear box is attached to the main rudder stock. The operating shaft for the auxiliary rudder extends down through the hollow main rudder stock and connects to the auxiliary rudder by yokes and parallel rods.

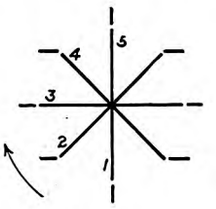

Fig. 15

The events that occur in the transition from going ahead to astern are illustrated in Fig. 15. In this example, the main rudder and the auxiliary rudder are both shown making a 0-degree angle with the direction of the ship. Upon reversing the engines, the current swings the main rudder around until it makes an angle of 180 degrees with the ship's head. The successive positions of the two rudders are shown in this figure. When the rudder reaches the 180-degree position the auxiliary rudder is ready to take up the control of the main rudder again. It is unnecessary for the helmsman to wait for the rudder to complete its swing. Instead he may immediately turn his wheel for heading the ship in the desired direction after reversing.

Saving in Power Effected

The following considerations indicate how great a saving in power may be expected for the steering gear. Instead of the large main rudder it is only necessary to operate a small rudder having about one-twentieth of the main rudder surface. A further saving arises from the fact that this rudder will not assume positions in which the center of pressure travels far from the axis, while with the normal rudder, under certain circumstances, the center of pressure may even reach the middle of the rudder. Under such circumstances, the strain on the steering gear is very great. Owing to the fact that such exceptional demands are not made on the steering gear with the current actuated rudder, the total saving in power, including also that due to the smaller area of surface moved directly, may amount to 97 percent.

Installation on the Frigido

Toward the end of 1920, the installation of the new rudder was begun by Wilton's Machine Fabriek en Scheepswerf of Rotterdam on the refrigerator ship *Frigido* of the firm of Wm. H. Mueller and Company. Since the spring of 1921, this ship has operated without interruption upon the routes London to Rotterdam, London to Antwerp, and London to Hamburg. The rudder has been proved by test on the *Frigido* in the busy Thames as well as in severe storms on the North Sea.

The operation of the rudder is carried on by hand gear from the bridge. A wire rope lead of 4 millimeters diameter runs from an automobile steering wheel to a small gear box on the hollow main rudder stock. The section chosen for this rudder is that cross section which gives the greatest rudder action for the least movement of the rudder, and has no apparently greater influence on the ship's resistance than the plate rudder.

It must be emphasized that the exact orientation of a rudder to the current has great influence upon the maneuvering power. Since the helmsman cannot take into consideration the changes of direction of the current leaving the ship, frequently the normal rudder is placed in positions very unfavorable for best steering, and furthermore the speed of the vessel is checked. Since the new rudder is influenced by the current, it automatically places itself in such a position relative to the altered current that it draws the greatest steering effect therefrom.

Action of Flettner Rudder Steadies the Ship

A property demonstrated on the *Frigido* is the great steadiness of the rudder action on the ship. This property is due to the very prompt response of the rudder and also to the fact that with the normal rudder, which is fixed, the ship is affected by all the changes in the current about it, both from the waves and from possible changes in the propeller action as the ship is thrown about. As a consequence, the ship is continually being thrown off her course by such influences which cannot be seen by the helmsman. Such behavior is suppressed by the current actuated rudder. The force of the waves has no such effect, since the rudder yields and is then immediately restored to position. It is interesting to observe in heavy weather how the main rudder indicator continually plays back and forth while the ship holds steadily on her course.

A safety factor with the current actuated rudder is the circumstance that the main rudder stock carries no torsion. Nevertheless the dimensions are made in accordance with the rules of the classification societies since they must con-

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sider the possibility that the auxiliary rudder may fail. For this same reason, the ship carries the customary emergency steering gear.

Testing Marine Boilers in France

By A. M. Thachara*

ACCORDING to French laws providing for the safety of navigation, new boilers, before being installed in vessels for which they are intended, must undergo a preliminary test at the works of the boiler constructors. The first trial at the works consists of a hydrostatic test at a pressure higher than that at which the boiler will be run under ordinary conditions. This pressure may reach twice the ordinary pressure, but the regulations do not permit excess pressure thus applied to exceed 142 pounds per square inch (10 kilograms per square centimeter).

When installed in a ship, all new boilers must undergo an additional cold water test at a pressure exceeding by one-half that indicated on the boiler as the regulation pressure permitted, but the excess pressure must not be less than 7.12 pounds (½ kilogram) or greater than 88.3 pounds per square inch (6 kilograms per square centimeter). As a general rule the length of time during which the boiler is subjected to the excess pressure varies from 5 to 10 minutes.

Exemption from Official Tests

Boilers which have passed the tests of recognized classification societies and which have been granted a first class certificate by such societies do not have to undergo the above mentioned official tests, as the societies' certificate is accepted by the French government.

*U. S. Consul General, Paris, France.

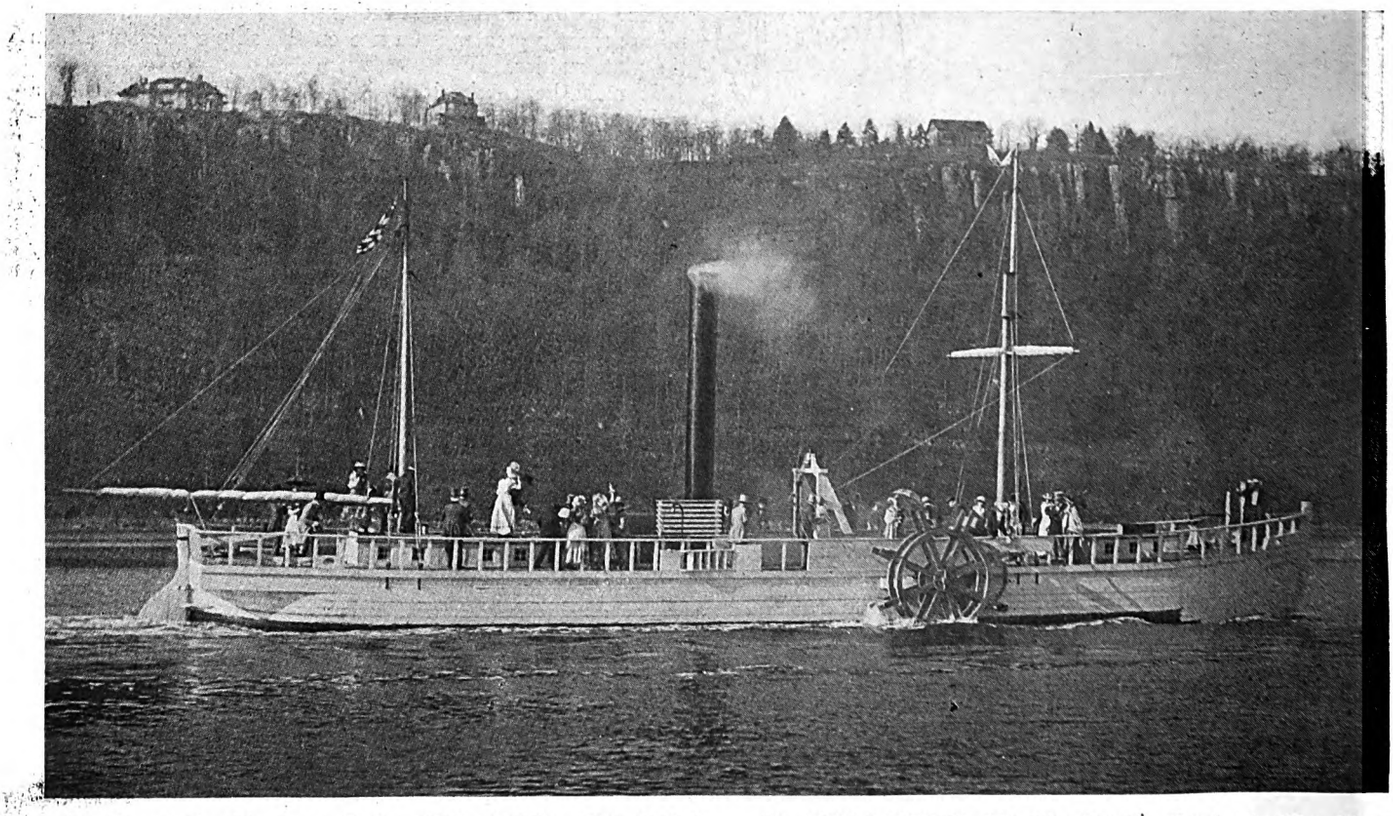
The Comité Central des Armateurs de France (French Ship Owners' Syndicate) states that the government and classification societies' boiler tests are practically identical, but that the hydrostatic test is not always insisted upon by the societies and that it is left to their experts to decide as to the desirability of such trials. As a result, it sometimes happens that boilers in French ships have never undergone the official hydrostatic test.

According to regulations, steamship boilers are inspected every year, and subjected to a pressure test every four years. The boiler is tested at a pressure equal to one and a half times that indicated and stamped on the boiler as being the normal pressure, but the excess pressure must not be less than 7.12 pounds (½ kilogram) or greater than 88.3 pounds per square inch (6 kilograms per square centimeter). The pressure test is made by the French authorities, who, however, exempt from such further tests, vessels holding a first class certificate from a classification society.

In addition to the four-year test, trials are likewise imposed by the regulations when boilers have undergone extensive repairs.

Decreasing the Pressure Rating

The proprietor of a vessel is entitled, at the time of inspection of a boiler, or when the four-year test takes place, to request that the pressure rating stamped on the boiler be lowered, if the boiler has already been in use or has undergone extensive repairs or has been in service more than a year since the expiration of validity of the last navigation certificate. In such cases the tests are made on the basis of one and a half times the new pressure rating asked for, the excess pressure not to be less than 7.12 pounds (½ kilogram) or more than 88.3 pounds per square inch (6 kilograms per square centimeter). If the boiler satisfactorily passes this test, the new rating is stamped on the boiler in lieu and place of the original figure.



A Replica of the Clermont, Robert Fulton's First Practical Steamship, Which Will Be Used by Marion Davies in Her Next Production, Entitled "Little Old New York." The Ship Is an Exact Counterpart of the Replica Used in the Hudson-Fulton Celebration and Was Built by the Kingston Dry Dock Company.

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Zinc Coatings for Shipbuilding Purposes Galvanizing and Sherardizing

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

THIS article has to do with the galvanizing or sherardizing of iron and steel members, fastenings, fittings, etc. of vessels, particularly those subject to salt water or salt air corrosion. A zinc coating is the most permanently efficient practicable method yet devised for protecting iron and steel from such corrosion; and it is therefore used wherever something better than paint or bituminous coatings is demanded. Although such a coating is usually for the purpose of adding to the useful life of the articles coated, it is often also desirable to avoid the streaking and discoloration of adjacent work by rust which would occur if the articles were not properly protected from corrosion. The zinc coating can be applied by hot process galvanizing, electro-galvanizing or sherardizing.

Whatever process is used, the articles have to be thoroughly cleaned, and the surface freed of scale, rust and grease. Acid is usually required in the cleaning process, together with the use of stiff brushes or mechanical tumblers. In some cases sand blasting or sand rolling in tumbling barrels takes the place of the acid. The sand blasting is particularly desirable with porous or bad castings, or where the pickling would impair the strength of the article.

Hot Process Galvanizing

Hot process galvanizing, which until about the beginning of this century was the only successful method of galvanizing, is accomplished by giving the articles a proper cleaning and drying and then dipping them in molten zinc. Large articles should be preheated so as not to chill the bath. When the articles are withdrawn from the bath, the excess metal is shaken or wiped off, and they are then usually dipped into hot water. The process is simple, and produces a thick, durable covering of zinc.

This coating is smooth when properly done but has a greasy and sometimes uneven and poor appearance, and paint or other coatings, where required, will not adhere to it until the coating has weathered or been specially treated. Small holes are filled up by this process of galvanizing, and bolt threads and other parts of that nature have to be recut or cleaned out, thus destroying the value of the coating on such parts of the work. The coating is thicker than required for most services, thus being wasteful of zinc. It is generally between 2 ounces and 3 ounces per square foot. There are also considerable losses of zinc in the process. Hot process galvanizing cannot be used for springs and other articles which would loose their temper or be weakened, warped or otherwise injured by the heat treatment.

Electro-Galvanizing

Electro-galvanizing is simply electro-plating with zinc, and all the technical requirements for successful electro-plating have to be complied with. The surfaces must be chemically clean and the articles must be placed in the plating tanks in a way to secure good electrical contact and a reasonably uniform deposit of the metal, and be left there a sufficient length of time to obtain the necessary thickness of coating. Up until about 1900 it was considered impossible to obtain a solution, or electrolyte, that with the use of zinc anodes would produce a non-porous and adherent sheet covering of zinc; but about that time inventions embodying the use of special materials in the solution such as a small amount of aluminum, which solved the difficulty, established electro-galvanizing on a commercial basis.

It can be readily realized that electro-galvanizing requires considerably more skill and care than hot process galvanizing, and that in an attempt to expedite delivery or to increase profits the coating may be too thin to afford efficient protection. When well done it is attractive in appearance and can be polished up if desired but all irregularities or imperfections in the surface of the article are faithfully reproduced in the coating. Other coatings, where desired, will adhere well to it.

Electro-galvanizing is particularly desirable for articles that are simple in form, for articles that might be weakened or otherwise injured by heat treatment, for springs, screens, bolts, pipe fittings, etc. Threads do not require recutting after electro-galvanizing. Interior surfaces of articles of considerable length and small cross section are apt to receive only a thin deposit of the metal from anodes outside of the article, and the bottoms of screw threads and similar recessed portions receive less of the metal than the other surfaces.

Sherardizing

In the process of sherardizing, the articles to be coated, after thorough cleaning and drying, are placed in a revolving container in an electric furnace with alternate layers of zinc dust. The zinc is first reduced to a gas by the heat of the furnace and this gas solidifies on and partly amalgamates with the surfaces of the articles to be coated. The result is a uniform and particularly efficient anti-corrosive coating. Considerations of practicability and cost usually limit its use for shipbuilding purposes to such articles as are difficult to galvanize properly or which when galvanized would require sufficient subsequent expense for cleaning out, fitting, etc., not required when sherardized. It is particularly desirable for surfaces subject to abrasion and for bolts, nuts, washers and small or intricate pieces that might be filled in by the hot process galvanizing or have some surfaces which would probably not obtain a sufficient thickness of coating by electro-galvanizing. It cannot be used for springs or other articles which would lose their temper or be otherwise injured by the heat treatment.

The coating has a uniform gray color which is attractive in appearance. It is one to which paint, enamel or electro-plating of other metals will readily adhere.

Selection of Type of Coating

Desires of naval architects and other interested parties are apt to be factors in determining the type of coating to use,

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in addition to considerations of suitability, availability of the process, cost and appearance. Where a vessel is classed the classification society requirements have to be met.

Hot process galvanizing is the method which by virtue of established position may be expected to receive general approval, and there should be no question of the approval of sherardizing for those items for which it is likely to be proposed. In some cases a classification society, owner or naval architect may consider it advisable to require hot process galvanizing of steel fastenings where they would allow electro-galvanizing if the fastenings were of iron, or they might require hot process galvanizing where the vessel is salted and allow electro-galvanizing where the creosote preservative method is adopted, or again they might require the former process for fastenings passing through oak, where the latter would be approved for fastenings through yellow pine. The corroding properties of oak have been referred to in the writer's article in the October, 1921, issue of this magazine. Electro-galvanizing has, however, made such strides in recent years that classification societies may be expected to give it general approval for all purposes for which galvanizing is required for shipbuilding, subject to the usual inspection given all such material in which they are interested and any tests that they may consider advisable to determine whether a sufficient thickness of coating has been obtained.

The U. S. Bureau of Standards in 1918 made a number of tests to determine relative values of hot process galvanizing and electro-galvanizing and the results obtained gave them no reason to believe that for an equal weight of zinc per unit of area the former was superior to the latter. Electro-galvanized specimens taking into account coating thicknesses withstood the salt spray test referred to later as well as, if not better than, specimens galvanized by the hot process, and the average weight losses per day under that treatment were practically identical for the two processes.

Tests of Zinc Coatings

The Bureau of Standards have also tried out different methods of testing zinc coatings. They came to the conclusion that the copper sulphate test for galvanizing or sherardizing was undesirable and that the salt spray method was the most satisfactory. For a quick test to determine the weight of zinc coating they have recommended the antimony chloride stripping test. They consider that the protective value of a coating as shown by the salt spray test is a better indication of its value than the actual thickness of the coating; and have suggested that samples be tested in this way and that if this test indicates a satisfactory coat, similarly treated samples can be stripped of their coating and the amount of zinc be used in checking up the work from day to day by the stripping method, with only occasional salt spray check tests.

These tests are very clearly described in the proceedings of a conference on the electro-plating of military supplies which was held at the Bureau of Standards on March 27, 1918, and the recommendations of this conference together with other valuable conclusions along the line of zinc coatings are here quoted. About fifty persons were present at this conference, representing various branches of the War and Navy Departments, manufacturers engaged on Government contracts, officers and members of the American Electro-platers' Society, and manufacturers of and dealers in plating supplies and equipment. The recommendations are:

1. For protection of iron and steel against corrosion, only zinc coatings should be employed.
2. It is not practical to specify the composition of solutions or conditions of operation to be employed for plating.
3. In the preparation of steel and iron for plating, sand blasting should be given preference to pickling.
4. Some form of corrosion test, such as the salt spray test, should form the primary specification for the quality of zinc plating; the quantity of coating to be suggested only as a secondary specification.
5. Where the quantity of zinc coating is to be suggested or specified, it should be expressed in terms of weight per unit area (or piece) as determined by some stripping test.

The reasons for and application of the above recommendations were set down as follows:

Use of Zinc Coatings

Numerous exposure and accelerated corrosion tests have confirmed the superior value of zinc coatings over copper, nickel or brass coatings for protection against corrosion. In view of this fact, it seems highly important that wherever protection of steel against corrosion is an important factor, zinc coatings should be employed. (*Note:* While this conference was concerned only with electroplating, it should be borne in mind that satisfactory zinc coatings may be produced by hot dipping, sherardizing and electroplating, so-called "electro-galvanizing.")

Composition of Plating Solutions

Desirable as it might be to insure uniformity of product by specifying the composition of plating solutions and conditions of operation to be employed, such a course is entirely impracticable, for the following reasons: (a) The best conditions of operation have never been definitely determined. (b) A large number of plating plants have neither the equipment nor experience necessary to analyze the solutions and control the conditions of operation. (c) Most platers have become accustomed to certain solutions and conditions of operation, and would find it difficult to obtain satisfactory results under new conditions. (d) Restricting the composition, etc., might exclude many satisfactory processes, and would discourage efforts to improve conditions of operation. Illustrations were given in the conference, of the confusion arising from attempts to specify the exact composition of solutions for black nickel finish.

Sand Blasting versus Pickling

It has been frequently shown that under some conditions serious weakening or embrittlement of steel may be produced during the pickling and plating operations. This effect, presumably due to the occlusion of hydrogen, is a surface effect, and is therefore more serious the smaller the cross-section, so that on fine springs, etc., pickling cannot be used. Experiments are in progress at the Bureau of Standards to determine the magnitude of such effects upon steel rods of various sizes and compositions. The results so far obtained upon 3/16-inch rods indicate that pickling under usual conditions reduces the elongation by about 10 percent, while the effects of plating itself are generally much less. In view of this fact, it appears desirable to replace pickling by sand blasting (or sand rolling) whenever possible.

Corrosion Tests

Where zinc plating is applied to steel to produce resistance against corrosion, it is obvious that some form of corrosion test is the only real criterion of the quality of the coating, since the resistance furnished by a given quantity of zinc depends on a number of factors; *e.g.*, the structure, uniformity, continuity, and adherence of the coating, all of which may in turn be influenced by the thoroughness with which the object is cleaned prior to plating. At the present time the "salt spray test" is probably the most reliable means of testing the resistance to corrosion afforded by a zinc coating. In practice the coating should be required to withstand corrosion for a specified number of days when exposed continuously at room temperature to the spray of 20 percent (by weight) sodium chloride solution. The number of days may vary with the needs; *e.g.*, two or three days for articles subjected to moderate exposure, or four days or more for extreme

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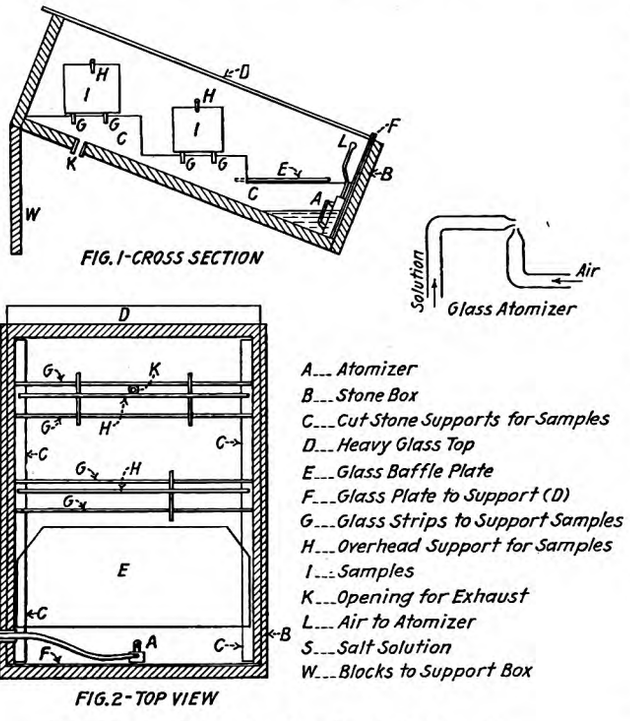
exposure; *e.g.*, on marine fittings. The essential features of the salt spray test to produce fairly uniform results are as follows:

SALT SPRAY TEST

The salt spray test may be conducted in any convenient non-metallic box or vessel provided with an inclined cover so as to prevent dripping of condensed liquid upon the specimens. A box constructed of Alberene stone, glass, stone-ware, or wood coated with bituminous paint, may be used. (The cut illustrates such a test apparatus.)

The 20 percent salt solution is prepared by dissolving 20 grams of sodium chloride (commercial table salt) in 80 cubic centimeters of water, or 1 pound of salt in 2 quarts of water.



Salt-Spray Box for Accelerated Corrosion

The spray may be produced by any form of air injector which will yield a very fine mist. An air pressure of 6 to 10 pounds per square inch will probably be required. The compressed air should first be passed through water in order to remove dust or grease and to saturate it with water vapor and thereby avoid evaporation of the salt solution. A glass baffle plate should be so placed as to prevent the spray from blowing directly against the specimens. The articles to be tested should each be suspended or supported, for example from glass rods, in as nearly a vertical position as possible, and should not be in contact with metal. They should be removed and washed off at 24-hour intervals or at the end of the specified period of test, and examined for the presence of red or yellow iron rust, the first appearance of which marks the conclusion of the test period. Valuable information may, however, be frequently obtained by continuation of the test to determine the extent of the corrosion on longer exposure.

COPPER SULPHATE TEST

It is recognized that a simpler and more rapid form of corrosion test to determine the quality of zinc coatings, is highly desirable. The Preece test (immersion in copper sulphate solution) was discussed at some length in the conference, and it was generally agreed that while it is of some value under strictly uniform conditions to indicate the thickness or distribution of the zinc coatings, the results of the test are not sufficiently reliable to warrant its use in specifications.

ANTIMONY CHLORIDE TEST

In some cases it may be desirable to supplement the salt spray requirements by a statement of the quantity of zinc coating probably necessary on a given article to produce the desired resistance. The quantity of zinc coating on any small articles may be quickly determined by a stripping test, *e.g.*, by lead acetate or antimony chloride solution, and may serve as an indication of whether the coating is of uniform weight on different samples, and approximately equal in amount to the coating on similar specimens which have passed the salt spray test. For irregular or threaded parts, the antimony chloride method is recommended. It is carried out as follows: A sufficient number of specimens should be used in each test to have an area of not less than 25 square centimeters (4 square inches). They are weighed (to the nearest milligram) and then dipped in 100 cubic centimeters (or more if necessary to cover the specimens) of concentrated hydrochloride acid (specific gravity 1.20) to each 100 cubic centimeters of which has been added 5 cubic centimeters of a solution made by dissolving 20 grams of antimony trioxide in 1,000 cubic centimeters of concentrated hydrochloric acid. The same portion of hydrochloric acid may be used repeatedly up to five times, by adding before each immersion an additional 5 cubic centimeters of the antimony chloride solution. The samples are immersed in the solution for one minute. They are then washed and scrubbed in running water to remove the deposited antimony, and are dried and reweighed. The loss in weight represents the weight of the zinc coating, which is calculated directly to grams per square decimeter; or to ounces per square foot by multiplying the grams per square decimeter by 0.328 (or for practical purposes, by dividing by 3). Often it may be most convenient, on irregular shaped parts, to express the weight in grams (or milligrams) per piece, thereby avoiding uncertainty as to the exact area of a specimen.

TOLERANCES

Consideration of the tolerances necessary and permissible upon threaded or other dimensioned parts, to allow for the thickness of metallic coatings, showed that the maximum tolerance possibly required (*e.g.*, 0.0025 inch on each surface) will not cause sufficient weakening of the threads as to be objectionable. For most plating applications it is probable that a tolerance of 0.001 inch on each surface will be sufficient.

The Bureau of Standards have supplemented the above mentioned recommendations as to the time that an article should resist the salt spray test by suggesting a test period of about 8 days as desirable for marine work. They have also expressed the opinion that one ounce of zinc per square foot of surface exposed, representing about .0017 inch in thickness, will give satisfactory protection, although as before stated they consider the protective value of the coating as shown by the salt spray test a better indication of its value than the actual thickness of the coating.

NEW AUXILIARY SCHOONER LAUNCHED.—The steel three-masted auxiliary schooner *Hussar*, which is being built from the designs and under the supervision of Cox & Stevens, naval architects, New York, by Burmeister & Wain, Copenhagen, Denmark, for Mr. Edward F. Hutton, New York Yacht Club, was successfully launched on March 15. This vessel, which will be one of the most superb auxiliary yachts in the world, is equipped with a 600 horsepower Burmeister & Wain Diesel engine operating a two-bladed feathering propeller, and will be delivered to Mr. Hutton in the early summer.

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The Merchant Marine Problem Can Be Solved

Now Is the Time for Every Real American to Renew the Fight All Along the Line

By "Old Scotch"

IN spite of a decided majority of the votes in the United States Senate, on every test given, the Administration's shipping bill was killed, through the bitter opposition of a coterie of misguided members, who refused to listen to reason, who absolutely ignored facts and who were determined, fanatically, to kill any kind of a measure which would help the American merchant marine. Their antics demonstrated to the people of the United States that our "most deliberative legislative body on earth" is ruled by a minority, and not by the majority.

It is not for us to rail at the unfairness of the entire Senate procedure, time will bring its own revenge, and the enlightened voters of this country will eventually take care of the men whose machinations in the Senate have made popular government farcical, in this, as well as in several other important legislative programs. Fair minded men would have permitted a vote, but radicals rule for a time, until aroused public sentiment comes to the rescue. Time and again in the history of Congress, this element has thwarted the will of the people, but soon they have returned to the oblivion from which they sprung. So let's dismiss this sore subject from our thoughts and look ahead.

As the experience of the past is the best guide for the future, the men interested in shipping, and especially those in the Government who are managing any legislation for the betterment of the merchant marine conditions, will do well to studiously avoid any more "next session" postponements. People familiar with Washington always take this "next session" talk with a grain of salt, and, in fact, look upon it as tantamount to an acknowledgement of defeat. In this case there seems a well-defined impression that some of the weak-kneed among Republican leaders put it over on President Harding's affable nature by their lamentations of possible defeat if the bill had been pressed during July and August. It could have been passed then, as the climate of the Capitol City has a very enervating and withering effect on filibustering tactics. Long distance talkers, soaked in perspiration, soon shut up. With visions of green fields and fence building at home, the farm "bloc" would have probably succumbed, when the humidity along the Potomac approached the saturation point, as it has a habit of doing in mid-summer.

Shipping Should Be Non-Partisan Issue

Another most important thing to avoid in shipping legistion of the future is the injection of party politics. As no Democrats were called in from the Hill when the ill-fated bill was in the making, the minority party naturally concluded that it was to be passed as a purely Republican measure. Partisan politics are never injected in legislation for the Army and Navy, and the merchant marine is just as much a national issue as are these two great arms of the national defense.

Neither the Republican nor the Democratic party platforms is ever framed without the inclusion of a plank pledging the respective parties to the upbuilding of American shipping. True, they generally differ as to the means advocated, but they have the same patriotic object to accomplish. Such a spectacle as the minority party calling a caucus and deciding on party opposition should never be allowed to occur again. The political differences should be threshed out before the introduction of the bill, and then let it be considered on its merits alone.

The one outstanding feature of all the debates on the late bill, was that no one seriously antagonized the idea of our having our own ships to carry our own products to foreign markets. In fact had a vote been taken on that question in the abstract it is doubtful if it would ever have been necessary to have had a roll call on the subject, as the sentiment in its favor would practically have been unanimous.

With such a sentiment as a decided asset for the proponents of an American merchant marine, and with eight months' time intervening before Congress again assembles in regular session, it behooves all elements interested in advancing our shipping to get together and formulate a policy which will arouse no opposition of a partisan nature. From statements in the public press, Chairman Lasker is quoted as saying that a new bill will be prepared and presented to the next Congress by the President in December. Just what form such a measure will take is, at this writing, a matter of great conjecture. In addition to the many real experts now in the Shipping Board, there seems but little doubt that before any measure is decided upon, the opinions of experts outside the governmental circles will be asked and given serious consideration.

Preferential Duties of Doubtful Value

Means for accomplishing the desired end are by no means exhausted in the failure of the so-called subsidy bill. Differential duties on imports are still authorized, and need but the annulment of some existing treaties to be put in effect. Now that this procedure is a possibility without further Congressional action, many shipping men are giving the subject serious consideration. Many well-informed men are doubtful as to the ultimate benefits to be derived from a reduction of duties on imports, if the goods are carried in American bottoms, for the reason that our principal imports are not of a bulky nature. While our exports reach an enormous tonnage, the same cannot be said of imports, for the reason that many of them come under the characteristics of luxuries or semi-luxuries and, in consequence, are valuable but not very bulky. For example, the following imports arranged according to value, have been received at our greatest port of importation, New York city, during the past six months:

Sugar, tobacco, woolen fabrics, cotton fabrics, vegetable fibers, diamonds and precious stones, silk manufactures, china and earthenware, fruit and nuts, clocks and watches, iron and steel manufactures, drugs and chemicals, perfumeries and cosmetics.

Sugar, of course, is dutiable and of great bulk; it therefore would encourage considerable American tonnage. Manufactured silk, diamonds and precious stones, clocks and watches, drugs and chemicals, etc., on the contrary while of considerable intrinsic value would do but little to encourage shipping, owing to the small weight and volume entailed for their transportation overseas.

Customs differentials would, of course, help considerably, but without other governmental aid it is doubtful if they would solve our problem.

Sale of Vessels at Low Rate Will Help

It is within the power of the Shipping Board to establish a real help for the next few years, at least, by selling the best

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of the ships to private American owners, at such a low rate that the interest, depreciation and insurance charges would be so small as to offset in the operating costs, the proposed direct aids contained in the recent ill-fated Merchant Marine Act of 1922. Naturally such a procedure would provide nothing for the highly essential replacement fund which all successful private corporations must consider. It would also work an injustice to the so-called pioneer purchasers of Shipping Board tonnage, except that by the purchasing of additional tonnage from the same source at much lower rates, the average cost of their equipment would be greatly lowered.

Consideration should be given to the possibilities of utilizing enlisted men from the regular Navy to man ships in the foreign trade, on the basis of a Naval Reserve, the Government to pay half their wages and the private shipowners the remainder. As it is incumbent upon the Navy to operate private shipping in times of war, it cannot be denied that the training of men to operate merchantmen is as essential as it is to train them to operate purely fighting craft. Such an arrangement would quite manifestly overcome the wage differential between American and foreign ships. Many of our competitors now adopt this method although the proposition of pay from the governments involved is much less than herein proposed.

Remove the Inefficient Tonnage

A great deal of discussion is now going on as to the disposition of the useless idle tonnage. The proposal to get rid of some 400 or 500 of the least efficient ships by scrapping or sinking at sea is one that should be given most careful attention. There is no doubt whatever that such craft should be withdrawn from any possible commercial usage, for the best interests of all concerned. But to deliberately sink that many craft, where there is no possible chance of further usage, even in time of possible great emergency, is a very serious question.

Would it not be better to select out the unfit vessels, withdraw them from any possible sale in time of peace, and store them as far as possible up some of the many available rivers, where the water is entirely fresh? A dozen men employed to prevent pilferage should suffice for each hundred of these ships. If we but recall how many vessels, which had been stranded for a number of years, were floated, patched up, and performed really valuable services when the great demands incident to war were on, it is not difficult to conclude that even for a period of ten years, these partly abandoned vessels might prove to be a great asset should any future emergency arise when the whole world may be clamoring again for "Ships, ships and yet more ships."

True, it might be necessary to provide new boilers, condenser tubes, and other parts vulnerable to the ravages of oxygen, but the point is that without any care involving expense, the hulls and heavy parts of machinery of such ships stored in fresh water, would be fit to use again. It would be much cheaper to patch up such old hulks than it would be to construct entirely new vessels at the inflated prices attending all great emergencies.

The setback we have received by the inanition of the Senate should not discourage us. We have received similar jolts before, but realizing that we are right, we should all keep up our courage and renew the fight all along the line.

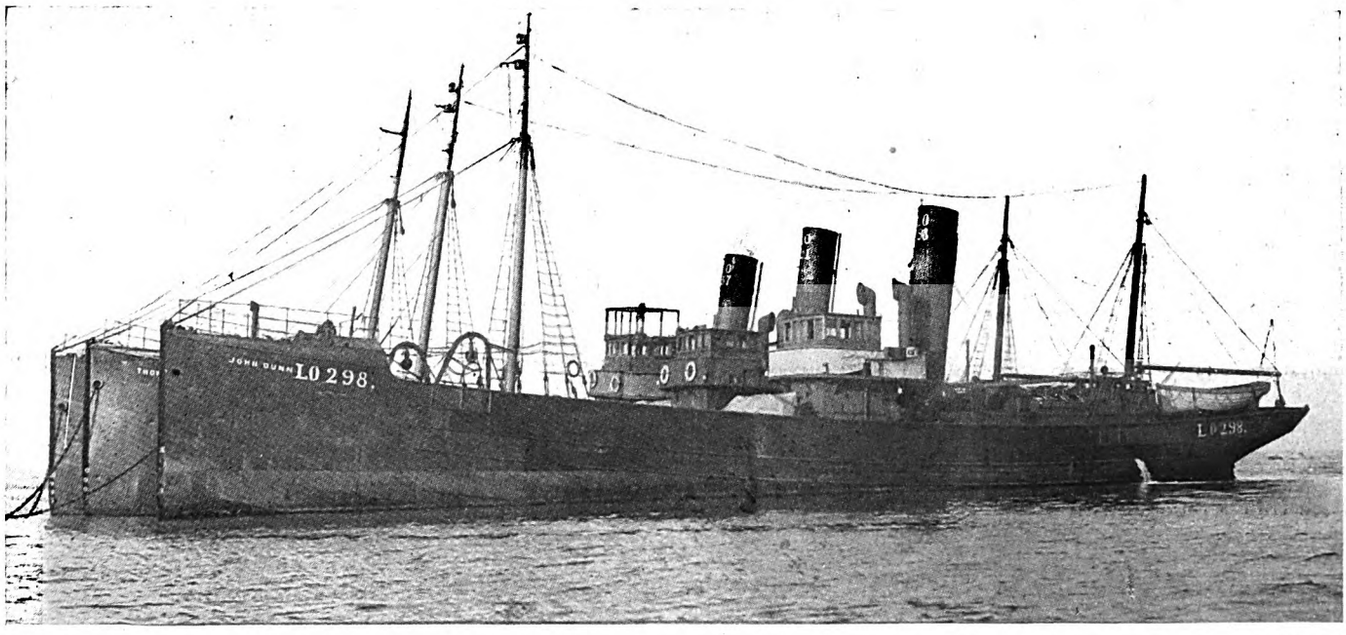
Propellers

(*Continued from page* 222)

a high figure for the resistances of the ship and is therefore of very little value for the purpose of arriving at true figures.

Owing to the very small actual twist in a ship's shafting, readings by torsion meter are naturally very small and when a ship is laboring at sea they become quite definitely inaccurate. For this reason some better means of arriving at the Q.H.P. might be tried, such as the use of an electric or mechanical flexible coupling, the displacement of the two flanges being calibrated for torque before installation on board ship.

The Shipping Board can do no greater favor to the ship operating industry than to initiate accurate tests on one or two freight ships. First, in the tank, with and without propeller, and later with instruments for carefully recording both the torque and the thrust. Tests with this device would have to be made at all speeds in smooth water over a deep water course and this could then be carried out also on one transatlantic voyage.



(*Photograph by Kadel and Herbert, N. Y.*)

The First Vessels for the Irish Navy

The three vessels shown in the above illustration are the first ships purchased by the Irish Free State. They are the first vessels to fly the Irish ensign, and will be fitted out as gunboats for patrol work.

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Current Admiralty Decisions of Special Interest

By Calvert B. Gill*

Breach of Affreightment Contract

THE rights and liabilities of the parties depending on general rules of maritime law are not subject to material alteration by State enactments declaring vessels navigating the waters of the State subject to a lien for damages resulting from nonperformance of affreightment contracts. The lien against a vessel for damages resulting from a breach of an affreightment contract does not attach before the cargo is delivered to and received on board the vessel.

Since the lien on a vessel for damages caused by a breach of an affreightment contract and the lien of the vessel on the cargo for the freight are mutual and reciprocal, receipt of part of the cargo called for by the contract does not entitle the shipper to a lien on the vessel for damages caused by its refusal to receive the rest of the cargo called for by the contract. Osaka Shosen Kaisha et al. vs. Pacific Export Lumber Company, 43 Supreme Reporter, 172.

Necessary Act of Sacrifice Comes Under General Average

ALL losses in a maritime adventure falling outside the contractual obligations of the parties and which arise from a voluntary sacrifice of a part of the cargo, made to save the whole adventure from perishing, or which arise out of extraordinary expenses or expenditures of money incurred for the joint benefit of both ship and cargo constitute a claim to general average contribution. It was said in the case of Aktieselskabet Fido vs. Lloyd Braziliero et al., 283 Federal Reporter, 62, that where a charterer, who had chartered the vessel for transportation of coal, delivered sufficient cargo at port of discharge under previous charter for stiffening but the coal so delivered was overheated at port from which the coal was to be transported, requiring the discharge of such coal and the loading of entirely new cargo, the loss caused by the delay constituted a claim to general average contribution since there was an imminent peril common to all interests, a voluntary, deliberate and intentional necessary act of sacrifice or expenditure made to preserve all interest and the act was attendant with success and the peril avoided.

Where a Release Signed by a Seaman Should Be Set Aside

THE release signed before a shipping commissioner by discharged seamen on settlement of their wages for the time served, as required by the Revised Statutes of the United States, section 4552, does not operate as a consent to their unlawful discharge. Although section 4552 provides that a release signed by a seaman thereunder on receipt of wages, "shall operate as a mutual discharge and settlement of all demands for wages," the Seamen's Act of March 4, 1915, section 4, provides that the court may upon good cause being shown, set aside such release and take such action as justice shall require. It was said in the case of Brown et al. vs. United States, 283 Federal Reporter, 425, that where seamen discharged without their consent or fault before commencement of the voyage, who were entitled under the Revised Statutes of the United States, section 4527, to an additional month's wages, were compelled to sign such a release to obtain payment of the wages admittedly due them, the release would be set aside and held not a bar to their recovery under section 4527.

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Concerning Changes in Wages

WHEN shipping articles have a provision in them, providing that the wages named were subject to change in accordance with a new scale to be adopted by shipowners, the court declared in Jones vs. United States, 284 Federal Reporter, 721, that the articles were invalid as they did not comply with the statute requiring the articles to state the wages to be paid, notwithstanding Revised Statutes of the United States, section 4511 provides that the articles may contain stipulations in reference to advance and allotment of wages, or other matters not contrary to law.

Injuries Sustained by Stevedoring Employees

IN Farrell vs. Waterman Steamship Corporation et. al., decision of January 25, 1923, the court says, that District Courts have jurisdiction in Admiralty of personal injury cases concerning employees of stevedoring companies notwithstanding the Act of Congress of June 10, 1922, as the provisions of the Act, denying to District Courts jurisdiction in cases of injuries to persons other than the master or crew of vessels for which compensation is provided by State acts, are unconstitutional under Article 3, sections 1 and 2 of the Constitution of the United States.

Ship's Liability When in Charge of Stevedores

A SHIP, in safe condition when placed in charge of a stevedoring company as an independent contractor for discharging and loading, is not liable in Admiralty for injuries to employee of such company by falling through a hatchway due to the negligence of the stevedoring company in leaving the hatchway uncovered after work had ceased at night and insufficiently lighted and also to contributory negligence of the employee, who knew of the open hatchway and with due care would have avoided it. The Kongosan Maru. 282 Federal Reporter, 666.

Seamen's Liability Cases in State Courts

ALTHOUGH the liability of an employer to a seaman injured in his employment was defined by the maritime substantive law, it was said by the court in Bonam vs. Southern Menhaden Corporation, 284 Federal

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Reporter, 362, that where the seaman elected not to seek redress in Admiralty, but to come into the law court, his remedial rights were governed by the procedure of the latter court and as limitations pertain to the remedy and not to the right, the defendant had the right to invoke the statute of limitations of the State, where there was no Federal statute of limitation. As there are no statute of limitations in Admiralty, the court may, in its discretion, apply the doctrine of laches as equivalent so that statutes barring old or stale claims are persuasive, but not controlling in Admiralty cases.

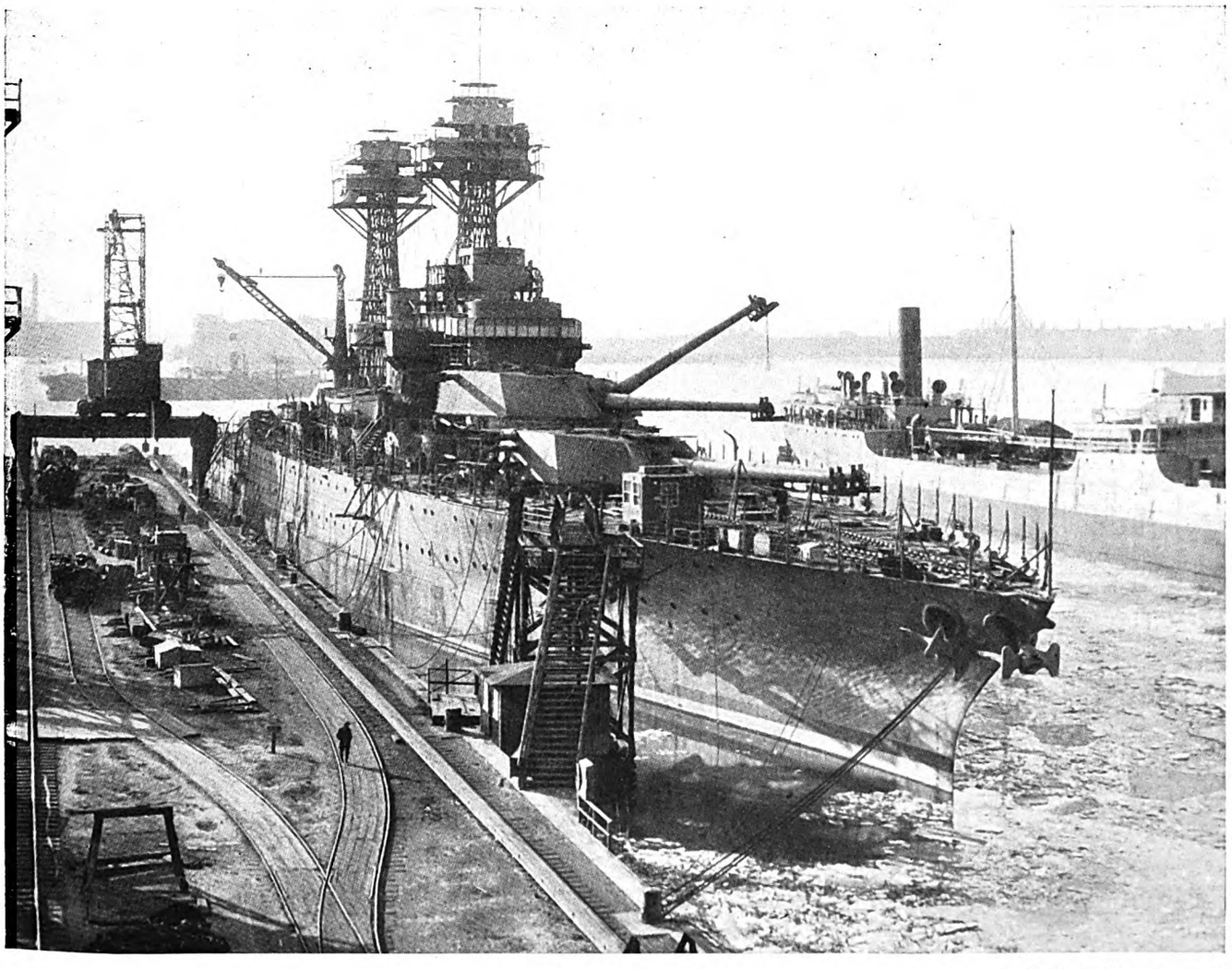
Properly Manned Condition Should Be Strictly Construed

THE Harter Act, section 3, exempting a ship and owner from liability for loss resulting from faults or errors in navigation, if due diligence has been exercised to make the ship seaworthy and properly manned, equipped and supplied, should be strictly construed, says the court in The Fort Morgan, 284 Federal Reporter, page 1, especially where exemption is claimed for losses due to stranding of the ship which was caused by the gross negligence of the engine room force, which had been selected by the owners without exercising the proper care required by the Harter Act in equipping and manning a ship.

Payment for Towage Contract

WHERE a contract for towage was made with charterer's undisclosed principal and one-half thereof was paid by such principal within thirty days after rendition of services and the principal was granted an extension of time for the payment of the other one-half, but payment thereof was not made because of the insolvency of the principal and where the charter provided for the payment of towage by charterer, there was no maritime lien for the unpaid one-half of the towage, even if a claim for towage could be maintained as a necessity within the Act of June 23, 1910, giving a maritime lien for necessaries. The Mona. 282 Federal Reporter, 468.

GREAT LAKES VESSEL LAUNCHED.—Specially designed for service on the Canadian Lakes and canals the *Glencorrie,* a single screw steamer, was successfully launched by Swan, Hunter, & Wigham Richardson, Ltd., from their Wallsend Yard on March 1. The principal dimensions are 250 feet in length between perpendiculars, 42 feet 6 inches in width, with a molded depth of 20 feet 6 inches. Water ballast will be carried in the fore peak and in the double bottom fore and aft. The propelling machinery consisting of a triple expansion engine and two single-ended Scotch boilers built by MacColl and Pollock, Ltd., Sunderland, is located aft.



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United States Battleship Colorado, Sister Ship of the California, Nearing Completion at the Yard of the New York Shipbuilding Corporation, Camden, N. J.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Determining the Strength of a Hollow Shaft and Coupling

Q. (1188).—Will you please show me how to find the strength of a hollow shaft and the strength of a coupling to suit a hollow shaft?—L. T.

A. (1188). To better illustrate the method to be followed in the design of marine shafting, an actual case of a hollow line shaft with its coupling will be worked out for a triple expansion three cylinder engine of 1,800 indicated horsepower and 90 revolutions per minute.

A = actual metal area of shaft cross section, square inches.
D = diameter of hollow shaft in inches.
D_s = diameter of solid shaft in inches.
E = effective thrust on shaft in pounds.
$E.H.P.$ = effective horsepower for designed speed of vessel. = 0.55 (assumed) × 1,800 = 990.
F = weight of shaft per running inch, in pounds.
L = greatest distance from center to center of bearings in inches = 144 (assumed).
S = speed in knots = 14.
T = maximum twisting moment on shaft, inch pounds.
d = diameter of shaft bore, in inches (= 0.6 × D assumed).
f = maximum allowable combined stress, pounds per square inch = 5,500 (60,000 pounds material assumed).
f_b = bending stress due to own weight, pounds per square inch.
f_s = shearing stress due to torsion, pounds per square inch.
f_t = compressive stress due to thrust E, pounds per square inch.
k = constant depending upon number and arrangement of cylinders.
= 1.8 for single crank.
= 1.4 for two cranks at 90 degrees apart.
= 1.32 for three cranks at 120 degrees apart.

$$T = \frac{0.92 \times I.H.P. \times k \times 63{,}024}{R.P.M.} = \frac{0.92 \times 1{,}800 \times 63{,}024}{90} = 1{,}159{,}700$$

(T for turbine shafts $= \frac{S.H.P. \times 63{,}024}{R.P.M.}$)

A rough estimate should first be made to determine the shaft diameter based upon solid shaft calculations.

$$D_s = \sqrt[3]{\frac{5.1 \times T}{f_s}} = \sqrt[3]{\frac{5.1 \times 1{,}159{,}700}{5{,}500}} =$$

10.24 square inches.

To determine the approximate outside diameter of a hollow shaft of the same strength, proceed as follows:

Where diameter of hole = 0.4 D add 1 percent
= 0.5 D add 2 percent
= 0.6 D add 5 percent
= 0.7 D add 10 percent
} to D_s

Therefore $D = 10.24 \times 1.05 = 10.75$

As the above calculations do not take into account bending and compressive strains it is safe to assume our shaft will be at least 11 inches diameter.

	Shaft Diameter, Inches		
D (assumed)	11	12	13
d = 0.6 D (use nearest even value)	6.625	7.25	7.75
D^4 =	14,641	20,736	28,561
D^2 =	121	144	169
d^4 =	1,926	2,763	3,608
d^2 =	43.89	52.42	60.06
L^2 =	20,736	20,736	20,736
$E = \frac{E.H.P. \times 33{,}000}{S \times 101.33}$	23,030	23,030	23,030
F =	17.21	20.40	24.30
$f_b = \frac{4 F L^2 D}{\pi (D^4 - d^4)}$	396	360	334
A =	60.56	71.82	85.56
$f_t = \frac{E}{A}\left(1 + \frac{16 L^2}{25{,}000 (D^2 + d^2)}\right)$	448	367	302
$f_s = \frac{5.1 T D}{D^4 - d^4}$	5,156	3,943	3,080
$f_a = f_b + f_t$	844	727	636
$f = \frac{1}{2} f_a + \frac{1}{2}\sqrt{f_a^2 + 4 f_s^2}$	5,545	4,324	3,416

Plotting values of D against values of f, the outside diameter D corresponding to the designed stress of 5,500 is found to give a diameter of 11.03 inches. The shaft would be 11 inches outside diameter and 6⅝-inch bore.

The material of the coupling will be taken as cast steel with a maximum tensile strength of 60,000 pounds per square inch.

Working stress allowable = 5,500.

Keys to be of same material as the shafting and designed for a safe crushing load of 11,000 (f_c) pounds and a shearing load of 4,500 (f_s) pounds per square inch.

D_1 = diameter of shaft in hub = 1.1 × D = 1.1 × 11 = 12.1 inches, approximately 12⅛ inches.

W = width of key.
B = length of key.

n = number of keys	1	2	3	4
$B \times b = \frac{2 T}{D_1 \times f_c \times n}$	17.38	8.69	5.793	4.345
$W \times B = \frac{2 T}{D_1 \times f_s \times n}$	42.5	21.25	14.17	10.625

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$\frac{W}{b}$ 2.445 2.445 2.445 2.445

one key $= \frac{d}{4} + \frac{1}{8}$ inch

W { two keys $= d/5.5 + \frac{1}{8}$ inch; three keys $= d/7 + \frac{1}{8}$ inch; four keys $= d/8.5 + \frac{1}{8}$ inch; Use one key.

$W = \frac{D}{4} + \frac{1}{8}$ inch $= \frac{11}{4} + \frac{1}{8}$ inch $= 2\frac{7}{8}$ inches

$b = 2.875 \div 2.445 = 1.176 = 1\ 3/16$ inches

B = length of key, also length of hub $= 17.38 \div 1.1875$
$= 14.64$ inches
$= 14\frac{5}{8}$ inches

$$D_2 = \text{diameter of hub} = \frac{4\,T}{f_s D_1 B} + D_1 + 2b$$

$$= \frac{4 \times 1{,}159{,}700}{5{,}500 \times 12.125 \times 14.625} + 12.125 + (2 \times 1.1875)$$

$= 19\frac{1}{4}$ inches.

The maximum permissible length of the coupling should be about 4 times the hub thickness.

Assume no taper to coupling bolts and the material to have a 60,000-pound maximum tensile strength. Safe shearing stress $= f_s = 4{,}500$ pounds per square inch.

d_1 = diameter of bolt, inches =	1¾	2	2¼
d_2 = nuts across corners =	3.1875	3.594	4.031
c = clearance between nut and hub, inches =	⅝	¾	⅞
c_1 = corner of nut to flange edge, inches =	⅜	⅜	⅜
D_3 = diameter of bolt circle, inches $D_2 + 2c + d_2$ =	23¾	24⅜	25
A = shearing area of bolt, square inches =	2.405	3.142	3.976
P = load at bolt circle $= \frac{2\,T}{D_3}$	97,660	95,160	92,760
N = number of bolts =	8	8	8
$f_s = \frac{P}{8 \times A} =$	5,075	3,785	2,916

Use eight 2-inch diameter bolts.

D_4 = diameter of flange $= D_3 + d_2 + 2c_1$
$= 24\frac{3}{8} + 3\frac{5}{8} + (2 \times \frac{3}{8}) = 28\frac{3}{4}$ inches.

The flange thickness is usually based upon an empirical proportion.

$t = 1.35\ d_1$ for cast iron
$1.15\ d_1$ for cast steel and wrought steel.
$t = 1.15 \times 2 = 2.3$ inches, use $2\frac{3}{8}$ inches.

It is assumed in your problem that I.H.P. (indicated horsepower) was inadvertently used in place of S.H.P. (shaft horsepower) as the shaft is for a turbine and not a reciprocating engine.

$$T = \text{maximum turning moment} = \frac{\text{S.H.P.}}{\text{R.P.M.}} \times 63{,}024$$

$$= \frac{7{,}500}{570} \times 63{,}024 = 829{,}400 \text{ inch pounds.}$$

D = diameter of shaft, inches $= 7$
d = diameter of shaft bore, inches $= 3.5$

$$f_s = \text{stress due to torsion, pounds per square inch} = \frac{5.1\,T\,D}{D^4 - d^4}$$

$$= \frac{5.1 \times 829{,}400 \times 7}{(7)^4 - (3.5)^4} = 13{,}153$$

The shaft material has a maximum tensile strength of 62,000 to 70,000 pounds which would not permit of a working stress of over 5,700 to 6,500 pounds per square inch. The shaft is therefore too small for good marine practice.

The above work is believed to be in sufficient detail as to method to enable you to work out your own coupling stresses as space does not permit of further discussion of the subject.

NEW BOOKS

Diesel Engines for Land and Marine Work

Reviewed by L. R. Ford*

Diesel Engines for Land and Marine Work. (Fifth edition). By A. P. Chalkley. Size, 5 by 8½ inches. Pages, 330. Illustrations, 161. New York, 1922: D. Van Nostrand Company.

This book as originally issued was the admirable result of the effort of the author to meet the need for a treatise that would supply a fund of general information to both the technical reader and the non-technical seeker after information regarding the Diesel engine.

The increasingly widespread use of the Diesel engine and the fact that practically all important marine engineering firms are prepared to manufacture it in one form or another have resulted in the development of new types and the improvement of old ones, to such an extent that the author has found it necessary to revise the book in order to bring it up to date. Notwithstanding the intensive development of the Diesel engine and the great refinement of mechanical details that has resulted, the basic principles of Diesel engine design, manufacture and operation have not changed enough to require any change in the text in the first six chapters of the book.

Chapter seven has been entirely re-written and enlarged and it is now a profusely illustrated description of most of the leading types of engines, including the latest and most radical departure from conventional design, the Still combined Diesel and steam engine. Chapters eight and nine are but slightly changed from the original editions.

It is to be regretted that, apparently in order to save space, the section devoted to small Diesel marine engines was glossed over very hurriedly. The development of these small engines has been so great since the first edition of the book that the author would have been justified in expanding this section to make an additional chapter. Such engines as the Leissner, Worthington, Berrz, Hvid, Crossly, Deutz, etc., are being produced in such numbers that the total horsepower in operation already probably exceeds that of the larger types but they have not received notice in the book. It is perhaps unfair, however, to demand more when the author has collected so much valuable information.

The outstanding physical feature of the book is the number and clarity of cuts with which the text is illustrated.

Only enough space is given to theoretical considerations to enable the reader to understand the why and the how of engine operation and the book should be of great value to the very large number of operating steam engineers who are seeking general information regarding the Diesel engine and especially to the marine steam engineers who wish to qualify

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for examination for license as Diesel engineers. To the technical reader the book's chief value is as a source of information regarding general details of construction as worked out by the various manufacturers.

The author's treatment of his subject indicates a very broad knowledge of practical Diesel engineering and everyone who has been for years familiar with his book in its various editions will welcome the new and up to date information contained in this enlarged edition.

PERSONAL MENTION

C. S. Doran, vice-president and general manager of the Sperry Gyroscope Company, Brooklyn, N. Y., recently sailed for England.

H. J. Bradley has been appointed San Francisco branch manager of the Chicago Pneumatic Tool Company to succeed J. K. Haigh.

J. F. Boreland, vice-president of the Huhn Manufacturing Company, New York city, is on an extended business trip to Japan and Hawaii.

A. P. Lane, fuel director of the State of Maine, was recently elected for membership to the Maritime Association of the Boston Chamber of Commerce.

D. A. Decrow, manager of the Water Works Department of the Worthington Pump and Machinery Corporation, New York, recently died at his home in East Orange, N. J.

Captain Herbert Hartley, commander of the American liner *St. Louis* during the war, has been appointed master of the *Leviathan*. As master of this liner, which will be placed

Captain Herbert Hartley

in the New York-English Channel service under the flag of the United States Lines probably in June, Capt. Hartley becomes commodore of the largest fleet of passenger vessels under the American flag.

Walter Maughan has been appointed manager of the steamship passenger business of the Canadian Pacific Railway on both the Atlantic and Pacific oceans. During the war Mr. Maughan did valuable work as chairman of the Demobilization Committee of the Canadian Railway War Board representing the Minister of Militia and was made a lieutenant-colonel in recognition of his work in the transportation of troops from Canada and China to France. Mr. Maughan was born in Toronto in 1876 and joined the Canadian Pacific forces in 1892. In 1897 he was made city passenger agent at Toronto and in 1913 district passenger agent. In the same year he was moved to Montreal as assistant general passenger agent and in December, 1922, became assistant to the general passenger traffic manager.

Calvin Austin, president of the Eastern Steamship Lines, Inc., has been elected president of the Old Dominion Steamship Company, recently acquired by the Eastern Steamship Lines. H. H. Walker, of New York, formerly president of the Old Dominion Line, has been elected vice-president.

Joseph S. Jones, who was recently appointed vice-president of Charles Cory and Son, Inc., New York, was born in Norfolk, Va., on March 1, 1888. His academic and technical education was obtained at St. Mary's Academy and Columbia University. Mr. Jones served a special apprenticeship course in naval, electrical and mechanical engineering at the Navy Yard, Norfolk, Va., for which he received the Secretary of the Navy's certificate and award. The positions that have been held by Mr. Jones are as follows: Hull draftsman, Navy Yard, Norfolk; electrical draftsman; electrical expert aide; senior electrical expert aide and assistant electrical superintendent; electrical superintendent (acting) in charge of naval electrical work including the fitting out of transports and the conversion of the ex-German liners in the Third Naval District to troopships; engineer and assistant to the vice-president, Charles Cory and Son, Inc., and general commercial manager and assistant to the president of the same company since 1921.

Joseph S. Jones

Mr. Jones has invented several mechanical improvements and equipment in the marine field, the principal of which are an electro-mechanical dry dock control system which is the first and only system of its kind in use; special watertight indicating rotary snap switches; a cutting machine for removing the cover on leaded and armored cable; watertight lighting fixtures; train semaphore signal system; valve position indicating system; watertight deck plug and receptacle; system of installing storage batteries in submarines; interior fittings for watertight connection boxes.

He is also author of several technical and scientific treatises covering various types of signaling and power equipment for the Navy Department; specifications used in connection with the conversion of merchant vessels to transports and the electrical work required for preparing ex-German ships for the transport service. He is also author of "Ship's Telegraphs and Their Uses." Mr. Jones served in Battery B, First Battalion, Virginia Field Artillery for four years (Norfolk Light Artillery Blues). He is a member of the American Institute of Electrical Engineers, Society of Naval Architects and Marine Engineers, New York Southern Society, the Virginians, New York Electrical League, the Old Colony and the Knickerbocker clubs.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Seventeen Millions in Ship Work

APPROXIMATELY seventeen million dollars in ship construction and reconditioning work is either about to be placed or is under serious consideration for the near future, according to latest information obtainable by MARINE ENGINEERING AND SHIPPING AGE. These figures, while forming a necessarily tentative estimate of the total involved, provide for the construction of five combination passenger and cargo ships and the reconditioning of six others.

The situation in regard to new construction is as follows: preliminary plans are in course of preparation by Theodore E. Ferris, naval architect and marine engineer of 30 Church Street, for two passenger and freight ships for the Clyde Line; two passenger and freight ships are contemplated for the Old Dominion Line; bids were received on March 20, and are now under consideration, for the building of one ship for the New York & Porto Rico Line. Tenders are also being received for the building of five self-propelled barges and forty cargo barges (all of steel construction) designed by the firm of Kindlund & Drake, naval architects and marine engineers of 17 Battery Place. The probable cost of these vessels as well as eight ferryboats to be built for the City of New York is not included in the figures given above.

In reconditioning work the market shows decided improvement with the outlook much brighter than it has been in many weeks. Contracts next in size to the *Leviathan* job are seen in the proposed reconditioning of the *Agamemnon* and *Mount Vernon*. The firm of Gibbs Brothers, Inc., No. 1 Broadway, who prepared the plans and specifications for the Leviathan work, have accepted a like contract in relation to the *Agamemnon* and *Mount Vernon*. Additional steel construction work on the hulls of these ships to increase their stability is under investigation, which, if carried out, will add materially to the original cost estimates.

Shipyards are at present preparing to submit bids on April 2 for the thorough reconditioning of the steamer *President Buchanan* and plans and specifications have been issued from the Shipping Board, at 45 Broadway, for the carrying out of alteration and additions to the steamship *President Adams*.

$100,000,000 Asked for Naval Program

ACCORDING to the last bulletin of the Atlantic Coast Shipbuilders' Association, the Navy Department in the preliminary estimates for the next budget is asking for an appropriation of almost $100,000,000 for auxiliary craft, cruisers and submarines.

These estimates are a part of the policy which has been recommended by the General Board for the purpose of bringing the United States Navy up to treaty strength in auxiliary craft. The entire program, which probably will be worked out on a three-year basis, calls for sixteen light cruisers of 10,000 tons with eight-inch guns and twenty-four submarines of 2,500 tons, half mine layers and half scouts, the cost of the completed program will approximate $300,000,000. The General Board recommends that six or eight of the cruisers and six of the submarines be provided for by the next Congress.

Bids Open April 12 for River Towboat Hull

SEALED proposals will be received by United States Engineer Office, Rock Island, Ill., until 11 A. M., April 12, for furnishing and delivering one steel hull for the towboat *Elinor*.

New York City Issues Plans and Specifications for Eight Ferryboats to Cost $1,475,000

PLANS and specifications for the construction of eight steel screw ferryboats have been issued by the Department of Plant and Structures of the City of New York. It is estimated that the total cost of the contract will be close to $1,475,000. The amount of security to guarantee the faithful performance of the work will be $50,000 for each boat and the first boat is to be delivered, entirely completed, within 140 consecutive days from the date of certification of the contract and thereafter one boat is to be delivered complete every twenty days.

General Dimensions

The specifications (A, B, C and D) provide for the construction, equipment and delivery of eight ferryboats, each having a length over guards of 130 feet, beam over guards 52 feet, beam of hull molded 36 feet, draft 8 feet 6 inches. The vessels are to be double-ended, constructed for the carrying of passengers and vehicles, each boat having three team gangways and two cabins on the main deck. The vessels are to be constructed according to the requirements of the American Bureau of Shipping.

Specification "B"

Specification "B" provides for the installation of single expansion, non-condensing steam engines for propulsion and steam operated auxiliaries, steam being generated in fuel oil fired boilers together with all necessary piping, fitting, etc., the hulls to be as specified with such modification as may be necessary for the proper installation of such machinery and equipment as called for in the specification.

Under this specification each engine is to have two cylinders not less than 16 inches in diameter and a stroke of not less than 18 inches, the engine developing sufficient horsepower at a speed of 180 revolutions per minute and at a steam pressure of 125 pounds to drive the boat at a speed of ten nautical miles an hour. The propellers are to be of open hearth cast steel, the shafts being of forged steel. There are to be two tanks for fuel oil, having a total capacity of 8,000 gallons and also two water tanks, having a capacity of not less than 1,500 gallons each.

Each boat will have two approved Scotch marine boilers not less than 7 feet in diameter by 11 feet 6 inches long, the boilers

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to pass the requirements necessary for 180 pounds working pressure.

EQUIPMENT

Each boat will have an approved feed water heater of the multicoil type, cast iron shell and copper or brass tubes, and to be arranged to take exhaust from the main engine; two approved horizontal feed pumps, 7½ by 4½ by 10 duplex or equivalent, pumps to be brass fitted; one approved horizontal fire pump, 7½ by 4½ by 10 duplex or equivalent, also to be brass fitted; Ashton type safety valves; boats to be steam heated, electrically lighted; life boats and similar equipment, according to United States laws.

SPECIFICATION "C"

Specification "C" provides for the installation of compound condensing engines for the propulsion of the vessels and steam operated auxiliaries, steam being generated in fuel oil fired boilers, together with all necessary pipings, fittings, etc. In this case, the boats are to have two approved compound, 2-cylinder engines with all appurtenances, the cylinders to be not less than 12 inches with 24 inches diameter and the stroke not less than 18 inches.

EQUIPMENT

Under this specification the equipment will include: the air pump, 7½ inches by 14 inches by 10 inches; vertical simplex beam air pump, having one steam cylinder, brass fitted throughout; one main condenser, independent of main engine; the cooling surface to be at least 1,200 square feet measure on the outside of the tubes; and one side inlet centrifugal pump of sufficient capacity, direct connected to an engine of sufficient power.

SPECIFICATION "D"

Specification "D" provides for propulsion of each boat by a vertical 6-cylinder, single acting, direct reversing, heavy duty oil engine (marine type) in which ignition is dependent solely on the temperature of compression. The engine must be of suitable design for direct connection to propeller shafting at both ends. The engine must be guaranteed to develop sufficient shaft horsepower to drive the boat at ten nautical miles an hour with piston speed under 760 feet per minute at revolutions not to exceed 190 per minute.

The boats, under this specification, are to be equipped with an approved generator having a continuous duty rating of 40 kilowatts, 115 volts at the normal speed of the engine, direct connected to an approved vertical fuel oil engine to provide current to light the boat and to drive the following motor driven auxiliaries with which the boat is to be equipped.

Auxiliaries	Horsepower of Motor
Two steering engines	8
Circulating water pump	5
Fire and general service pump	10
Maneuvering air compressor	15
Fuel oil pumps	5

Each boat is also to be equipped with the following motor driven auxiliaries, connected up and ready for use: auxiliary air compressor with a capacity of 40 cubic feet of free air per minute; circulating water pump, with a capacity of 7,500 gallons per hour with a reserve unit of equal capacity; fuel oil pump, with a capacity of 2,100 gallons per minute with a reserve unit of equal capacity.

Electric steering engines of approved design are to be provided and each boat will be equipped with an approved fuel oil burning boiler with piping of sufficient capacity to heat the cabin and pilot houses.

Homer Ferguson Tells Propeller Club United States Cannot Maintain Position Without Strong Merchant Marine

WE have one thing at least in connection with the defeat of the recent shipping bill that we ought to be thankful for, said Homer L. Ferguson, president of the Newport News Shipbuilding and Dry Dock Company, in addressing a recent luncheon at the Propeller Club, and that is, that we don't have to listen any more to the opinions of Congressmen representing various sections of the country, and this also applies as well to editors of newspapers, including some of New York city's leading dailies, who know next to nothing about the problems of the shipping industry.

In speaking of the present situation, he pointed out that a large number of Shipping Board vessels should be sunk or scrapped. In fact, he declared that if they were operated they would surely break the company that tried to run them. The first thing to be done in stabilizing the present situation is to get rid of inefficient Government tonnage.

Mr. Ferguson spoke very earnestly and feelingly about our naval sea power and he hoped that the ten-year holiday would carry with it a program for strengthening our merchant marine, for that must be done if the United States is to maintain her position. Whatever nation controls transportation will also control the politics and welfare of the world, he declared.

The time has not come when you can leave your business to others, said Mr. Ferguson, and in his opinion to scrap 11 battleships that cost over $300,000,000 and then allow our chief competitor to build two more in order to catch up with us was an idiotic policy.

In speaking of constructive economic laws, Mr. Ferguson believed that we never again, in our time at least, would be able because of the strength of financial interests to pass an economic measure unless it had the support of both parties. In regard to shipping, he pointed out that all you had to do to find out why the shipping bill did not pass was to pick up a list of the directors of English shipping lines. The answer is that plenty of ships exist and the other fellow has got them.

Referring to the Jones Act, Mr. Ferguson declared that the clauses seeking co-operation with the railroads had never been enforced and railroad interests were arrayed against American shipping. The transportation Act, he said, which practically guarantees a 5½ percent return to the railroads on their net investment, may not be a subsidy but at least it is a very substantial aid.

SENATOR COPELAND TO SUPPORT SHIPPING

Senator Royal S. Copeland pledged his support to American shipping in every way that he could conscientiously. Senator Copeland said that the evidence of prosperity in any country was shown by its seaports and that unless the Government recognized all elements that make for prosperity good times could not be permanent. He did not believe that any country was pursuing a wise policy unless it made ample provision for its shipping and its seaports to secure the carriage of its products. The senator made a stirring plea along the lines recently advocated by Colonel Roosevelt, namely: that individual citizens inform themselves concerning the merits of public questions.

SHIPPING POLICY MUST BE NON-PARTISAN

Winthrop L. Marvin, vice-president and general manager of the American Steamship Owners' Association, said that any constructive shipping policy should have the support of both parties and our merchant marine as our Army and Navy must be made a non-partisan issue.

Cooperation of Shipping Industry Sought

Questionnaires Issued Relating to Best Means for Disposing of Government Fleet

THE committee of the Shipping Board, consisting of Commissioners Lissner, Thompson and Chamberlain, who were appointed to study and prepare details of a plan for transferring Government vessels to private ownership, issued invitations to the American Steamship Owners' Association, the United States Ship Operators' Association and the Council of American Shipbuilders to send committees to Washington during the last week in March.

The result of these conferences is not known at the time this is written but the main questions under consideration were as follows:

1. In your opinion could buyers be found for Shipping Board vessels who would give a guarantee to maintain those vessels upon a prescribed service, if the Board, in return for this guarantee, expressed the willingness to sell the ships in question at less than the world market price for similar tonnage?
2. Over what period of time do you believe it is practicable to require a guarantee of service?
3. What in your opinion should be the nature of this guarantee?
4. What in your opinion should be the Board's policy with regard to the sale of good tonnage which is not required for operation upon desirable trade routes, especially as to (a) sale to citizens, (b) sale to Aliens?
5. What in your opinion should be the Board's policy with regard to tonnage which is inferior in design, equipment or general condition?
6. To what extent and on what terms can capital be raised upon shipping in today's financial market, and what can be recommended to facilitate the financing of purchases from the Board?

Personal

G. H. FROEBEL, formerly manager of the Houston, Texas, branch office of the Westinghouse Electric and Manufacturing Company, has been appointed manager of the marine sales department of the company, effective April 1 with headquarters at the East Pittsburgh works of the Westinghouse Company.

JOHN N. ROBINS, founder of the Robins Dry Dock and Repair Company, Brooklyn, N. Y., and for many years associated with William H. Todd, president of the Todd Shipyards Corporation, died on March 25 at his home in Greenwich, Conn., aged 71.

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American Ship and Commerce Corporation Makes Big Gain

THE consolidated income account of the American Ship and Commerce Corporation for 1922, after deducting fixed charges, shows a profit of $1,790,610.39, as compared with $1,045,084.46 for 1921, according to the annual report recently made public. The aggregate net income of the parent company and its subsidiaries was a profit of $2,545,770.95, against a loss of $711,445.38 for 1921, or an increase of about $3,250,000.

The report shows a considerable decrease in the surplus account, from $5,466,000 in 1921 to $975,000 in 1922. This decline, it is explained, is due to the sale of seven cargo vessels, upon which there was a loss of $2,111,000, and the adjustment of values of other ships to accord with market values.

The parent company received dividends of $3,264,472 from its stock in the William Cramp & Sons Ship and Engine Building Company, which, it is understood, was utilized in the purchase of the new passenger steamers *Resolute* and *Reliance*. The report states that new loans of $5,000,000 were made during the year to finance the purchase of these ships, which works out at the rate of about $145 a gross ton.

"The betterment in the operation of the shipping companies was $1,620,000 and in the shipbuilding and manufacturing approximately $1,540,000. The improvement in the case of the shipping companies may be explained as follows:

"1. The sale of seven cargo vessels, after several months' idleness, resulted in materially reducing costs by the elimination of lay-up charges and depreciation.

"2. Reductions in the operating and up-keep expense of the entire fleet.

"3. The profitable showing made by the new first-class steamers *Resolute* and *Reliance*."

The report says that the industrial activities of the company, carried on largely through Cramp's, are proving profitable and are steadily increasing in volume and importance. At present all the manufacturing plants of the Cramp company and its subsidiaries are running at capacity and further expansion will be necessary.

R. H. M. Robinson, president of the American Ship and Commerce Corporation, states that the failure of the ship subsidy bill does not materially affect the company's prospects, as the *Reliance* and *Resolute* have been transferred to the Panama flag, and other plans have been made without counting upon government support. The outlook for shipping generally, he says, depends upon adjustment of the financial and economic difficulties in Europe.

Income of New York Shipbuilding Corporation Reduced

The depression in shipping, the limitation of armaments and cessation of construction for the Shipping Board resulted in a considerable decrease in the business of the New York Shipbuilding Corporation in 1922, according to the annual report made public last month.

Net income for the year was $1,026,267, at the rate of about $5 a share, as compared with $1,996,559 in 1921 and $2,395,402 in 1920. Dividends were paid at the rate of $1.50 a share, as compared with $4 a share in the previous two years. Surplus for the year amounted to $726,267, which made the total surplus $6,140,905, subject to Federal income taxes.

The gross income last year amounted to $1,184,517, against $4,899,671 in 1921. Nothing was charged to amortization of plant, as compared with $1,943,386 for this purpose the previous year.

Ships Ordered in 1923

DURING the first quarter of 1923 contracts were placed in American shipyards for 85 vessels of various types, including two express passenger steamers for coastwise service, a 13,000-ton freighter for the Great Lakes, seven Diesel-engined craft, a number of tugs, two dredges for the government, and a large fleet of steel barges for inland waterways service.

The vessels ordered since the first of the year are as follows:

Two passenger steamships, 402 feet by 72 feet 6 inches, to Sparrow's Point Plant of Bethlehem Shipbuilding Corporation, Ltd. by Eastern Steamship Lines, Inc., Boston, Mass., price $3,600,000.

Two fishing steamers, one 140 feet long and the other 135 feet long, to M. M. Davis & Son, Baltimore, Md.

Combination towboat and lighter, 90 feet by 20 feet, to Vineyard Shipbuilding Company, Milford, N. J., by Cuban-American Sugar Company.

Bulk freight steamship, 604 feet by 60 feet by 32 feet, to Toledo Shipbuilding Company, Toledo, O., by Reiss Steamship Company, Sheboygan, Wis.

Steam lumber schooner of 1,200,000 feet capacity to Peninsular Shipbuilding Company, Portland, Ore., by A. B. Johnson Lumber Company.

Maneuver boat to Midland Barge Company, Midland, Pa., by U. S. Engineer Office, Huntington, W. Va., price $21,475.

Dipper dredge hull to Penn Bridge Company, Beaver Falls, Pa., by U. S. Engineer Office, Pittsburgh, Pa., price, $23,145.

Three steel deck barges to the Independent Bridge Company by U. S. Engineer Office, Pittsburgh, Pa., price $40,000.

Self-propelled houseboat, 60 feet by 16 feet 4 inches, to George T. Johnson and Sons, Cambridge, Md., for Charles B. Bossert, Brooklyn, N. Y., price, $25,000.

Eight steel barges, 140 feet by 25 feet by 11 feet, and one barge, 280 feet by 50 feet by 11 feet, to Alabama Dry Dock and Shipbuilding Company, Mobile, Ala., by the Tennessee Coal, Iron and Railway Company.

Two steel oil burning tugboats, 105 feet 9 inches by 24 feet by 12 feet 9 inches, to Tebo Yacht and Basin Company of Todd Shipyards Corporation by Standard Transportation Company, New York.

Five steel barges to Green Bay Dry Dock Company, Green Bay, Wis., by U. S. Engineer Office, Milwaukee, Wis.

Two Diesel towboats, 63 feet by 14 feet, to Hildebrand Shipyards, Kingston, N. Y., by Transmarine Corporation, New York, price $75,000.

Steel oil barge to Los Angeles Shipbuilding and Dry Dock Corporation, Los Angeles, Cal., by Associated Oil Company, price $45,000.

Two Diesel ferry boats, 120 feet long, to St. Helen's Shipbuilding Company, St. Helens, Ore., by Long-Bell Lumber Company.

One tug, 58 feet, by 17 feet by 8 feet, to the Erie Basin Shipyard, Buffalo, N. Y., by the Niagara Ferry and Transportation Company.

Four steel barges to the Nashville Bridge Company, Nashville, Tenn., by U. S. Engineer Office, Florence, Ala.

Pipe line dredge, 175 feet by 50 feet by 8 feet, to the Charles Ward Engineering Works, Charleston, W. Va., by U. S. Engineer Office, Cincinnati, O., price $275,000.

Fourteen steel barges, 100 feet by 25 feet by 5 feet, to the Penn Bridge Company, Beaver Falls, Pa., by U. S. Engineer Office, Nashville, Tenn., price, $156,535.

Three steel barges, 80 feet by 26 feet by 5 feet, to the Riter-Conley Manufacturing Company, Pittsburgh, Pa., by U. S. Engineer Office, Huntington, W. Va., price, $32,190.

Four steel dump scows, 144 feet by 37 feet by 11 feet 8 inches, to the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., by U. S. Engineer Office, Philadelphia, Pa., price, $190,000.

Two motorships to Great Lakes Engineering Works, Detroit, Mich., for Minnesota Atlantic Transit Company, Duluth, Minn.

One oil barge, 87 feet by 28 feet 4 inches by 8 feet, to the Noank Shipyard, Inc., Noank, Conn., by U. S. Engineer Office, Philadelphia, Pa., price, $21,900.

Twenty steel barges to the American Bridge Company, Ambridge, Pa., by Pittsburgh Coal Company, Pittsburgh, Pa.

America Contract Goes to New York Navy Yard

THE reconditioning and conversion of the steamship *America* into a cabin and third-class liner is to be carried out by the New York Navy Yard. The decision to award the contract to the Navy Yard, according to reports, was due to a belief on the part of Shipping Board officials that all bids were too high and that this matter could be adjusted more expeditiously by giving the job to the Navy Yard on the cost basis. The board appears to be uncertain as to the amount of work it will authorize but it is by no means uncertain in its decision to return the *America* to its berth in time to meet her sailing date of June 2.

It is not clear why this contract could not have been adjusted just as satisfactorily at a guaranteed price with private repair plants. Certain it is that the total bids submitted, including the Navy Yard estimate, did not vary materially and surely not enough to guarantee that the price of the job on the cost basis would not exceed the bid of the lowest bidder—the Morse Dry Dock and Repair Company.

According to Mr. E. P. Morse, president of that company, the Shipping Board had no choice in calling for figures from the Navy Yard because there is a law specifying that when work done on a Government-owned or controlled vessel exceeds $100,000 in cost the nearest available navy yard must have a chance to estimate. Notwithstanding this law, the award of the job to the Navy Yard brought immediate protests from individual plants on the ground that the Navy Yard had no overhead or capital charges to meet and still further that it was not fair to tax commercial enterprises so that the money could be used to undermine their business.

Idle American Seagoing Tonnage Shows Decrease

ONLY a little more than 10 per cent of privately-owned American ocean-going steam tonnage was unemployed on January 1, 1923, according to a summary statement issued recently by the American Steamship Owners' Association, 11 Broadway. On July 1, 1922, 15.7 per cent of American ocean-going steamships was unemployed; on January 1, 1922, 23.5 per cent was unemployed.

Idle privately-owned American steamers numbered only 92 of a total of 320,405 gross tons register on January 1, 1923, as compared with 124 of 522,567 tons on July 1, 1922, and 171 of 780,653 tons on January 1, 1922.

This present improvement in the business of American shipping, according to Winthrop L. Marvin, vice-president and general manager of the American Steamship Owners' Association, "is due mainly to improved business within the protected coastwise trade of the United States, including the intercoastal trade via the Panama Canal."

To Build Two Barges

SEALED proposals will be received at the United States Engineer Office, Galveston, Tex., until 2 P. M., April 16, 1923, for furnishing and delivering two 1,200-barrel steel barges complete, afloat at any port on the Gulf of Mexico accessible to a seagoing tug drawing 12 feet of water.

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Intercoastal Services Still Rapidly Growing

Shows What American Shipping Can Accomplish Under Favorable Conditions

THE increased activity in the movement of cargoes in the intercoastal trade is the most marked development in the employment of ships under the United States flag, during the past year. The employment of privately owned ships in the trade with other countries, where keen competition makes economical operation imperative and where our ships are handicapped by high operating costs has rapidly decreased; so rapidly in fact that at the close of the last quarter of 1922 our privately owned cargo tonnage was represented in the foreign trade by only 119 vessels, of which 61 were engaged in trade with the West Indies and Caribbean countries. Of the balance engaged in overseas trade, 26 were vessels owned by the large industrial companies engaged principally in the transport of their own products. Thus it will be seen that our privately owned American vessels on whom the burden of competition with foreign carriers falls are represented by a meagre total of 32 vessels. Other than the vessels of the United States Shipping Board, our merchant marine in foreign service does not equal the fleet of one good-sized British company.

Private Vessels Seek Intercoastal Berths

The vessels under private ownership have practically abandoned the hopeless task of competing with the more cheaply operated foreign fleets, and have turned to the protected traffic of our coastal waters, where the basis of operation cost is equal, and an opportunity is presented of making a profit through increased efficiency in fair competition. A survey of the intercoastal business for the last quarter of 1922, shows how rapidly commerce can be developed where American shipping is not throttled by the lower operating costs which prevail on the vessels of other nations.

For the last three months of 1922 the total cargoes moving in intercoastal trade amounted to 1,227,612 long tons, of which 336,691 tons were oil cargoes in tankers. The movement in eastbound traffic from the Pacific to the Atlantic and Gulf ports, excluding the oil cargoes, amounted to 479,144 long tons, while the westbound movement from the Atlantic and Gulf to Pacific ports amounted to 411,777 long tons.

Rapid Increase in Oil Cargoes

The rapid increase in the movement of oil cargoes from the West Coast to the Atlantic is worthy of special comment at this time. The mounting output of the California oil fields guarantee us against curtailment of supply in case any large percentage of productive wells in the Mexican fields should run to salt water. The total oil movement by ship from the West Coast amounted in the last quarter of 1922 to 335,191 long tons or about 2,300,000 barrels, an increase over the previous three months of approximately 1,000,000 barrels.

For the same quarter, our imports of oil from Mexico amounted to 4,102,000 long tons, or approximately 28,000,000 barrels, a decrease from the figures for the corresponding period of 1921 of 1,368,000 long tons or about 9,425,000 barrels. This decrease has practically been absorbed by the development of the California fields and a decided increase in the movement of tankers in intercoastal trade is noted.

The general growth of the intercoastal business has greatly increased the number of vessels employed, and new companies have entered the field with large, well-equipped vessels. There were 143 vessels of 1,356,584 deadweight tons employed during the last three months of 1922, as compared to 93 vessels of 912,570 deadweight tons employed during the previous quarter. The total sailings from Atlantic to Pacific ports during the quarter comprised 107 vessels of 1,047,743 deadweight tons while from the Pacific to the Atlantic 109 vessels of 1,036,744 tons deadweight departed, making a total number of sailings in the three months' business of 216 vessels and 2,084,487 tons deadweight.

Secret Oil Deal Suspected

SENATOR ROYAL S. COPELAND, in an address before the Propeller Club on March 23, declared that the private car of Harry F. Sinclair, head of the Sinclair Oil Company, stood on a siding at Three Rivers, New Mexico, for three days just before the tremendous oil deposits at Teapot Dome, Wyoming, were leased to the Mammoth Oil Company.

Three Rivers is the home of Albert B. Fall, former Secretary of the Interior, and it will be remembered that the Teapot Dome wells, formerly known as Naval Petroleum Reserve Number 3, were removed from the jurisdiction of the Navy Department to the Department of the Interior. The lease was signed on April 7, 1922, but not made public until April 14, 1922.

The State of Wyoming and Secretary Edwin Denby protested against the lease and Senator La Follette caused a senatorial investigation of the deal to be made. It is believed that the lease was made without competitive bids and Senator Copeland pointed out that it was significant that just before the lease was made Mr. Sinclair's private car was held on a siding at Three Rivers for three days. Senator Copeland said that he was not through with this Teapot Dome episode.

Atlantic Coast Shipbuilders to Meet on May 14

THE annual meeting of the Atlantic Coast Shipbuilders' Association will be held in Philadelphia on Monday, May 14. This meeting, which will be attended by the executives from the shipyards and ship repair plants from all sections of the Atlantic and Gulf coasts, will be given over almost entirely to the serious problems confronting the shipbuilding industry.

It is known that several members have already found some very decided views on what should be done individually and collectively by the shipbuilders and others are requested to give immediate thought to the same subject.

Install Sperry Gyro-Compasses

Sperry gyro-compasses have recently been installed on Standard Oil Company of New Jersey tankers, *F. W. Weller, O. T. Waring* and *James McGee* and on the *Lillian Luckenbach* of the Luckenbach Line.

Annual Meeting of U. S. Chamber of Commerce in New York May 7-10

Transportation and European problems as they affect American business will be the general topics considered at the eleventh annual meeting of the Chamber of Commerce of the United States, which is to be held in New York, May 7 to 10. Grouped within the broader discussion will be a series of exchanges of views that should prove of real value to the forward looking men in the various lines of industry. A group session will be held for each cross-section of American business, including a foreign commerce group which will show the direct application of Europe's tangled affairs to American business.

British Shipping Exhibition

The annual British Shipping, Engineering and Machinery Exhibition will be held this year at Olympia, London, from August 31 to September 22.

TRADE PUBLICATIONS

De Laval Equipment.—A manufacturing plant in which low pressure steam for process purposes is supplied from a turbine of special design is described in a profusely illustrated leaflet issued by the De Laval Steam Turbine Company, Trenton, N. J. This turbine operates automatically either as a straight condensing turbine, as a back pressure turbine, as a bleeder turbine, or as a mixed flow turbine or as a low pressure turbine, in such a manner as to maintain a balance between power requirements, low pressure steam requirements, hot water requirements, and the amount of power available from water power. This is accomplished by a third pressure controlled valve, in addition to the high pressure and low pressure valves ordinarily controlled by the steam governor in a mixed flow turbine. The utilization of exhaust steam for heating and process purposes, or the production of power as a by-product from steam used at low pressure, offers surprising economies, and this leaflet will therefore repay careful study by steam users in these times of high fuel costs.

Portable Timing Device.—Accuracy of .1 in 60 seconds is attained in a portable timing device, described in Bulletin No. 46053, recently published by the General Electric Company. This device consists of an encased clock, to be used with a standardized clock as a means of secondary timing, to supplant the stop watch. The portable timing device has applications which enable its use with graphic instruments, measurements of angular velocities, and for indicating a definite time interval ranging from one second to any whole number of minutes. As illustrated in the Bulletin, the instrument consists of a clock, relays, and a gear train which by adjustment can be set to meet different demands of service. Power is supplied from a local flashlight type of battery. Errors as great as .4 second are frequently introduced through the use of stop watches, according to this Bulletin, which quotes from an article "The Limitations of Stop Watches," by A. L. Ellis. In addition to cutting the possibility of error down to .1 second, the portable timing device can be utilized for measurements ordinarily requiring a combination of instruments.

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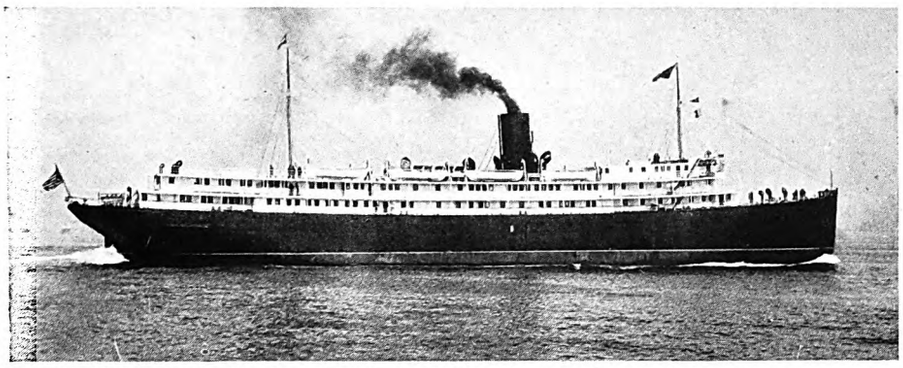
Coastwise Steamship Berkshire Launched

THE new coastwise steamship *Berkshire*, of the Merchants and Miners Transportation Company of Baltimore, was successfully launched at the yard of the Federal Shipbuilding Company on Saturday, March 17. The sponsor was Miss Mary Franklin Cromwell, daughter of Mr. W. K. Cromwell, of Baltimore, a director of the Merchants and Miners Transportation Company.

The *Berkshire* is a sister ship of the *Alleghany*, which recently completed her sea trials and is about ready for delivery. Both



New Merchants and Miners' Coastwise Liner Alleghany

ships will operate in the coastwise trade between Baltimore, Savannah and Jacksonville. These vessels have the following dimensions and characteristics:

Length overall	368 feet
Length between perpendiculars	350 feet
Beam, molded	52 feet
Displacement	7,000 tons
Passenger accommodations:	
First-class	205
Steerage	27
Speed at sea	12 knots
Engine	4 cylinder reciprocating
Boilers (four)	Scotch

These vessels have been designed particularly for comfortable travel at sea. Ample public spaces have been provided. Special features consist of many private baths with salt water connections; single berth rooms; facilities for handling all types of automobiles, including limousines and other types of closed cars; modern electric lifeboat handling devices, and many other features that add to the comfort and safety of the passengers.

It is hoped and expected that these vessels will be the forerunner of orders for additional ones from many other of the American coastwise companies, who really should begin to modernize their fleets, if they want to make them attractive to the traveling public.

Atlas-Imperial Engine Company Opens New York Office

The Atlas-Imperial Engine Company, of Oakland, Cal., builders of marine and stationary Diesel engines, announce the opening of offices and display rooms at 115 Broad street, New York City.

New Ryerson Plant in Cincinnati

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has purchased the plant, stock and good will of the Cincinnati Iron & Steel Company, Cincinnati, Ohio.

Contracts About to Be Awarded in Start of Norfolk Terminal Project Which Will Cost Several Millions

NORFOLK, VA. (Special)—Bids for bulkheading and dredging the Hardy tract on the inner harbor of Norfolk to pave the way for development of that 3,000-foot waterfront into a system of industries on the plan of the Bush terminal in New York, were opened this week and contract for the work will be awarded early next week, according to Colonel M. A. Butler, in charge of the project. He said this feature of the development would cost in the neighborhood of $135,000.

Colonel Butler said that two of the plants, which will be a part of this development, will be under construction in a short time and would be ready for business not later than January 1, 1924. He was not prepared to disclose the nature of the industries.

The entire project, which Colonel Butler said will eventually run into the millions, has been financed by a syndicate, of which George Norris, Philadelphia banker, is the principal member.

Harry Carlton and Associates Open New York Office

HARRY CARLTON AND ASSOCIATES, sales engineers, have opened an office at 30 Church Street, New York City, representing the Matthews Engineering Company, Sandusky, O., manufacturers of emergency electric lighting plants; the National Engineering Company, Providence, R. I., manufacturers of national "3-00" plastic furnace lining, cement and baffle compounds; the Needham Gas Appliance Company, Passaic, N. J., manufacturers of the Needham high pressure gas systems.

The associates are Harry Carlton, formerly sales engineer for the General Electric Company; Albert H. Morrill, formerly superintendent of mines, Central Chile Copper Company, Ltd.; J. Y. Gillespie, formerly superintending engineer for Sigsbee Humphrey Company, steamship agents. In addition to the above lines, Mr. Gillespie also represents Keystone Interlocking Fiber Tiling, Metalastic Packing and "Precision" Feed Water Testing Company.

Charter Gas Engine Company Takes Over Mietz Oil Engine

THE Charter Gas Engine Company, Sterling, Ill., announces the purchase of the entire "MIETZ" oil engine (also known as "Mietz and Weiss") business, heretofore carried on at 128-138 Mott Street, and 430 East 19th Street, New York City, by the August Mietz Corporation and the Reliance Oil Engine Corporation. This effects a merger and consolidation, under one management, of two of the oldest internal combustion engines in the world.

American Marine Association to Stage Spring Banquet at Waldorf-Astoria

THE American Marine Association will hold a spring get-together banquet at the Waldorf-Astoria Hotel, New York City, on the evening of May 3. Senator Royal S. Copeland, Captain William Stayton, president of the Baltimore Steamship Company; Mr. Joseph E. Sheedy, vice-president of the Emergency Fleet Corporation, and other prominent men in the marine field will deliver addresses at this gathering.

The American Marine Association, in addition to staging the annual Marine Exposition at the Grand Central Palace, is acting throughout the year as a chamber of commerce in the marine field. It is busily engaged in conjunction with the Department of Commerce and the Shipping Board in promoting standardization and simplification of shipbuilding and ship engineering parts, a movement which Secretary Hoover has successfully started in many other industries. The object of the banquet is to bring the maritime field together in closer contact and to develop suggestions that can be acted upon in building up our merchant marine.

Shipping Board Appoints Central Fleet Survey Committee

AFTER a conference with captains, naval architects and engineers, port engineers and caretakers of the laid-up fleet, the Shipping Board Committee on Survey, consisting of Vice-Chairman O'Connor and Commissioners Plummer and Benson, has appointed a central fleet survey committee to outline proceedings to be followed in making a complete survey of the Government-owned fleet. This committee consists of J. H. Philbin, manager of ship sales, chairman; J. E. Bailey, manager of the repair division at New York; James Swan, naval architect, division of ship sales, and A. Conti, consulting engineer, division of ship sales.

Upon the adoption of a plan of procedure the central fleet survey committee will act.

Double Acting Four Cycle Diesel Engines Ordered

BURMEISTER AND WAIN, LTD., of Copenhagen, Denmark, have received an order from the Swedish-American Line for two double acting, four cycle Diesel engines of 7,000 horsepower each to be installed in the company's new 560-foot passenger liner now building for the New York-Gothenberg service. Burmeister and Wain are now prepared to furnish this new type of engine in sizes ranging from 4,000 to 8,000 horsepower.

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Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Overhauling, Newport News, Va.—The Norwegian steamship Romsdalshorn has been taken to Newport News for repairs.

Schooner Repairs, Norfolk, Va.—The schooner West Hardaway was towed to Norfolk for repairs to be made by Harriss, McGhill & Company.

Gunboat Repairs, Charleston, W. Va.—The gunboat Wheeling, for some time stationed at Key West, has been taken to the Charleston Navy Yard for repairs.

Hull and Boiler Repairs, Mobile, Ala.—The tug Marion was placed on the docks of the Alabama Dry Dock & Shipbuilding Company for hull, boiler and several minor repairs.

Overhauling, San Francisco, Cal.—The ship Star of Lapland, of the Alaska Packers' Association, has been placed on the ways of the General Engineering Company for overhauling.

Steamer Reconditioning, Norfolk, Va.—The Old Dominion Transportation Company is reported to be expending approximately $400,000 in reconditioning two steamers for passenger service.

Painting Steamer, Etc., Baltimore, Md.—The excursion steamer Charles Macalester was placed on Woodall's drydock, Baltimore, recently, for painting and preparing for the summer business on the Potomac.

Overhauling, Oakland, Cal.—The contract for generally overhauling and making interior changes in the Pacific mail steamer President Wilson was awarded to the Moore Shipbuilding Company, to cost $9,528.

Contract Awarded, Kearny, N. J.—The contract for reconditioning the steamship West Africa, allocated to the Bull Lines, has been awarded to the Federal Shipbuilding Company. Estimated expenditure, $45,000.

Restepping Mast, Chester, Pa.—The Sun Shipbuilding Company received the contract for restepping of the foremast of the Nawsco steamship Wabash, carried away while lifting a heavy reel of wire rope. Approximate cost of repairs, $15,000.

Overhauling Contracts, Oakland, Cal.—The schooner Thistle was placed on the Hanlon Dry Dock and Shipbuilding Company's ways for overhauling, and the Associated Oil Company's bay carrier Midway for overhauling and installation of a new capstan.

Miscellaneous Repairs, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded the work of docking the steamship Hugoton for examination, scraping and painting, drawing tail shaft for inspection and some boiler and machine work.

Overhauling, Baltimore, Md.—The steamer Emma Giles has been placed on the ways of the William E. Woodall & Company for overhauling for the summer Tolchester excursion season. The B. C. and A. steamer Joppa will follow her in dock for an overhauling.

Machinery and General Repairs, Mobile, Ala.—The Todd Shipyard and Dry Dock Company, Mobile, received the contract for making extensive machinery and general repairs to the Sinclair Oil Company's tank steamer W. L. Connelly. Approximate cost, $40,000.

Extensive Repairs, Wilmington, N. C.—Diamond Steam Boat and Wrecking Company was awarded the contract to raise the sunken steamer Kingston, now resting in 30 feet of water in Cape Fear River. After being raised and securely fastened to barges she will be towed to the marine railway for extensive damage repairs.

General Repairs, San Francisco, Cal.—The Bethlehem Shipbuilding Company received the contract for overhauling, drydocking, cleaning, painting and performing general repairs on the E. R. Ritch & Company's tanker Broad Arrow. The bids were: Bethlehem, $1,395; Moore's, $1,285.

Steamer Reconditioning, Mobile, Ala.—The steamship Effingham has been placed on the docks of the Alabama Dry Dock & Shipbuilding Company to have her tail shaft drawn for inspection, cleaned and painted from keel to load line, to install zinc plates, renew rivets, and various other repairs.

General Repairs, Oakland, Cal.—The contract for general repairs to the United States Geodetic Survey steamer Discoverer has been awarded to the Hanlon Dry Dock and Shipbuilding Company. The following bids were submitted: Hanlon's, $2,181; Moore's, $2,243, and General Engineering, $2,294.

Vessel Launched, Toledo, O.—The freighter Worrell Clarkson, building for the Kinsman Transit Company, Cleveland, was launched on March 17 by the Toledo Shipbuilding Company. The vessel is 600 feet overall length, 60 feet beam and 32 feet deep, and is to be delivered to her owners on April 15.

Launch Construction, Oakland, Cal.—The Crowley Launch Company, of San Francisco, has started the construction of four launch hulls, which will be equipped with 150-horsepower Diesel engines. The vessels will be sixty-four feet long, eighteen feet beam, and will have two fuel tanks for storage of 2,000 gallons.

Contract Awarded, Oakland, Cal.—The Moore Shipyard was awarded the contract for making changes in the Shipping Board steamer President Pierce. The following bids were received: Moore, $9,854; General Engineering Company, $12,340; United Engineering Company, $12,472; and Bethlehem Shipbuilding Company, $12,681.

Reconditioning, Baltimore, Md.—Steamers Santa Cecilia and Corvus, formerly of the Green Star Line and now of the Planet Steamship Corporation, have been awarded to the Maryland Dry Docks for reconditioning. The approximate expenditure for reconditioning the seven ships formerly of the Green Star Line will be $100,000.

Low Bidder, Oakland, Cal.—The Crowley Shipyard was low bidder for general repairs to the steamer Susquehanna, work including voyage repairs, etc. Seven yards submitted tenders, which were: Crowley's, $4,123; General Engineering, $4,243; Bethlehem, $4,828; Hanlon's, $4,843; Moore's, $4,882; United Engineering, $5,385, and Main Iron Works, $5,570.

Damage Repairs, Seattle, Wash.—The contract for making extensive repairs to the steamship Commercial Traveller, of the Moore & McCormick Steamship Company, of New York, has been awarded to the Todd Dry Docks, Inc., of Seattle. Twenty-five of the plates will be removed and replaced in addition to other repair work. Approximate expenditure, $100,000.

Boiler Repairs, San Francisco, Cal.—The Crowley Shipyard was low bidder for making boiler repairs to the steamer Susquehanna. The following proposals were submitted: Crowley's, $1,965; Smith & Scanlon, $2,020; United Engineering, $2,049; Bethlehem, $2,270; Moore's, $2,933; Hanlon's, $2,940, and the General Engineering and Shipbuilding Company, $2,949.

Diesel Engine Installation, Chester, Pa.—The Sun Shipbuilding Company, Chester, Pa., is installing Diesel engines in the following ships, recently bought from the Shipping Board; steel tanker Bidwell, 10,254 deadweight tons, 7,641 gross tons; steel tanker Miller County, 10,254 deadweight tons, 7,366 gross tons; and the steel cargo carrier Challenger, 11,850 deadweight tons, 7,955 gross tons.

Miscellaneous Repairs, Los Angeles, Cal.—The Los Angeles Shipbuilding and Dry Dock Corporation has been awarded the following contracts: Shipping Board tanker Tulsagas, machinery and hull repairs; Standard Oil tanker E. T. Bedford, machinery and hull repairs; Standard Oil tanker F. Q. Barstow, maintenance repairs; Standard Oil tanker Walter Jennings, extensive machinery and hull repairs; British tank steamer, the San Fraterno, drydocking and repairs.

Machinery Installation, Jacksonville, Fla.—Power suction pumps for use in supplying the dredges with boiler water are being installed on the U. S. E. D. tug Brannan, at the plant of Merrill-Stevens Company, Jacksonville. The machinery is intended primarily for use in operating the dredges in that district, but will also be adaptable for fire fighting. The intake suction pipe measures eight inches in diameter and there are several hose lines that can be played on flames.

Shipyard Work, West Coast.—The following contracts have been awarded to West Coast shipyards: Spreckles yacht Venitia and Mexican States Line steamer Colima to be drydocked for overhauling, cleaning and painting, to the Bethlehem Shipbuilding Corporation; steamer W. R. Chamberlin, Jr., installation of new booms and self-discharging and loading gear, to Hanlon Shipyards; and the cutter Pioneer and transport Buford for reconditioning, to the Moore Shipbuilding Company.

Reconditioning of Vessels, Oakland, Cal.—The Moore Shipbuilding Company will carry out reconditioning and repairs costing $200,000 on the steamers Lake Frances and Lake Cayuga, recently purchased from the Shipping Board. The changes will include the installation of four masts, eight new booms, new winches, changing the fuel system from coal to oil, placing of new steel guards on vessels, and other work. They will have an average speed of 10.65 knots and will be used as lumber carriers.

Ferry Launched, Staten Island, N. Y.—The new Staten Island ferryboat W. R. Hearst was successfully launched at Staten Island on March 17. She is equipped with 2,200 horsepower General Electric turbine generator, supplying 2,300 volts to the two induction motors, which are connected to the propellers. These motors have two speeds, 2,100 horsepower, at 176 revolutions per minute, used for driving the ferry and 100 shaft horsepower at 122 revolutions per minute, used to turn over the bow propeller.

Conversion to Oil Burner, Weems, Va.—Humphreys Railway, Inc., has been awarded the contract for the installation of oil burners in the E. H. Hubbard, Jr., of the Taft Fish Company. It is understood that this vessel is the first fishing schooner of a total of between 75 and 100 of such craft in the vicinity of Chesapeake Bay which are likely to undergo similar reconditioning. The boats are about 140 feet long by 18 feet beam, the propelling machinery developing about 750 indicated horsepower with steam supplied by a single-ended Scotch boiler with three furnaces.

SHIPYARDS AND DRY DOCKS

New Drydock, New Orleans, La.—The ninth of a chain of shipyards, operated by the Todd Shipyards Corporation, will be established in New Orleans within a few months, according to General Manager M. F. Hart. This will be a shipbuilding, drydock and repair plant, involving an investment of $3,000,000.

Drydock Sold, Portland, Ore.—The 2,000-ton drydock operated by the Columbia River Drydock, Engineering & Construction Company, of Portland, Ore., has been sold to J. L. McLain and Otis Cutting, of Seattle. The operation of the dock in low-

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ering and raising a hull, it being a one-section type, is controlled by compressed air.

Drydock Sale, Boston, Mass.—According to announcement by Sidney Henry, Director of Sales of the Emergency Fleet Corporation, the Atlantic Works, Boston, Mass., has bought the 6,000-ton steel floating drydock, built by the Ramberg Drydock & Repair Company, and the purchaser expects to tow the dock from Brooklyn to Boston within the next few weeks. The Shipping Board still has five drydocks for sale, including three 10,000-ton wood floating drydocks located in New York harbor; one 10,000-ton wood floating drydock located near Providence, R. I., and one 6,000-ton wood floating drydock located at Jacksonville, Fla.

PORT IMPROVEMENTS

Harbor Improvements, Port Stanley, Ont.—Harbor of Port Stanley is to be improved. $100,000.

Grain Elevator, Port Arthur, Ont.—J. Richardson & Sons, Royal Bank Building, Toronto, plan concrete addition to grain elevators, Port Arthur. $500,000.

Pier, Sheboygan, Wis.—A pier is planned with docking facilities, hoisting and unloading machinery, etc., on Lake Michigan near South 8th street. J. Steimle, city clerk.

Wharf and Terminals, Corpus Christi, Tex.—Plans are being prepared for a wharf and terminals along Corpus Christi Harbor. Price, $4,000,000. Sands & Cummings, Houston, engineers.

Drydock Machinery, Esquimault, B. C.—R. C. Desrochers, Secretary, Department of Public Works, Ottawa, Ont., received bids on March 15 (change of date) for machinery for drydock at Esquimault.

Grain Elevator, Norfolk, Va.—Norfolk Port Commission is having plans prepared for a gallery addition to grain elevator, Hampton Roads; price $180,000. Folwell & Ahlskog, Sewells Point, architects.

Dredging, Etc., Houston, Tex.—Anderson, Clayton & Company, Mason Building, is taking bids for dredging channel for 600-foot wharves, concrete warehouses, etc. Price, $1,000,000. W. L. Clayton, manager.

Terminal, Los Angeles, Cal.—Outer Harbor, Dock and Wharf Company (Union Oil Company, controling interests) plans terminal wharves, docks, etc., on harbor front at Los Angeles. Cost, several million dollars.

Grain Elevator, Ft. William, Ont.—The Western Terminal Elevator Company awarded a contract to Eagles Construction Company, Ft. William, for reinforced-concrete addition to elevator. Engineer's estimate, $500.000.

Grain Elevators, Port Arthur, Ont.—Gillespie Grain Company, 187 Grain Exchange Annex, Winnipeg, Man., are having plans prepared to rebuild and extend reinforced-concrete grain elevators at Port Arthur. $800,000.

Bulkhead, Wildwood, N. J.—R. H. Coney, 106 East Garfield street, Wildwood, received the contract for constructing a bulkhead and for sandfill improvements on beach front from Schellenger to Montgomery avenues. Price, $41,478.

Grain Elevator, Port Arthur, Ont.—Saskatchewan Co-operative Elevator Company, Regina, Sask., is having plans prepared for a reinforced-concrete addition to the port grain elevator; $500,000. C. D. Howe & Company, Whalen Building, engineers.

Contract Awarded, Baltimore, Md.—The contract for dredging and making fill at McComas street Bulkhead, 1,300,000 cubic yards, was awarded to Sanford & Brooks, Commerce and Water streets, and Arundel Corporation, Fidelity Building. Price, $304,000.

Woodpile Wharf, Wilmington, Cal.—Pacific Coast Borax Company, Central Building, Los Angeles, has had plans prepared by A. C. Martin, architect, Higgins Building, Los Angeles, for a 900-foot woodpile wharf, this being part of a $1,000,000 improvement plan.

Levees, Etc., Yuba City, Cal.—Reclamation District 1550 has had plans prepared for reconstructing levees, enlarging canals, etc. Price to exceed $500,000. J. Crowley, California Fruit Building, Sacramento, Cal.

Wharf, New Orleans, La.—Sealed proposals were received by the Board of Commissioners of the Port of New Orleans, Suite 200, New Court Building, on March 22, for furnishing, erecting and painting of steel framing required for wharf structure at Poland Street Landing.

Dock, Superior, Wis.—The Great Northern Railway, Railway Building, St. Paul, Minn., plans to rebuild No. 1 ore dock at Allouez Bay, plans calling for reconstruction of inner 188 pockets and increasing height of dock from 73 to 77 feet, timber construction; $1,500,000. R. Rudd, president.

Ferry Landings, Toronto, Ont.—City and Board of Harbor Commissioners, Harbor Building, are planning new ferry landings at foot of York street and at Toronto Island, $26,000 and $38,000, respectively. R. C. Harris, city engineer. E. L. Cousins, Harbor Building, engineer of Harbor Board.

Improvements, Palo Alto, Cal.—Plans are being prepared for the development of Mayfield Slough, 42-acre site, roadway on levee to landing, $5,550: timber quay wall, 500 feet long, $8,214; dredging channels, $2,600; grading and graveling landing, $2,750; warehouse, $5,400, etc. J. F. Byxbee, Jr., city engineer.

Contract Awarded, Dallas, Tex.—The Jones Hettelslater Construction Company, 706 Mutual Building, Kansas City, Mo., received the contract awarded by the Pearlstone Mill & Elevator Company, Hickory street, for a reinforced-concrete addition to grain elevator, 200,000 bushels capacity. Price $60,000.

Pier Construction, Charleston, S. C.—Engineers are preparing plans and specifications for the construction of a pier, costing $150,000, to be built on property now occupied by piers Nos. 1 and 2 of the Union wharf at the foot of Market street, due to a suggestion to the Port Utilities Commission by Mayor John P. Grace.

Contract Awarded, Vancouver, B. C.—The Dominion Construction Company, Ltd., 509 Richards street, Vancouver, was awarded the contract for constructing a 700,000 bushel grain elevator, concrete storage house, timber work house and wharf on Burrard Inlet, by E. A. Woodward, Grain Exchange, Winnipeg, Man. Price $500,000.

GOVERNMENT WORK

Boilers, Florence, Ala.—U. S. Engineer plans to purchase and install four steam boilers.

Harbor Dredging, Claibourne, Md.—U. S. Engineer plans dredging in Claibourne Harbor.

Piling, Louisville, Ky.—U. S. Engineer plans to purchase steel sheet piling for Dam 44, Ohio River.

Lock Gates, Nashville, Tenn.—U. S. Engineer plans steel lock gates for Lock S, Cumberland River.

Excavation, Wilmington, Del.—U. S. Engineer, Wilmington, plans dredging in Chesapeake and Delaware Canal.

Lock Gates, Chattanooga, Tenn.—U. S. Engineer will purchase lock gates for Widows Bar Lock and Dam.

Dredging, New York, N. Y.—U. S. Engineer, 2nd District, plans dredging and rock removal in New York and New Jersey Channel.

Dredging, Rouge River, Mich.—U. S. Engineer Office, Detroit, Mich., received sealed proposals on March 17 for dredging in Rouge River, Mich.

Wharf, Norfolk, Va.—Specification 4777.—Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon take bids for extension to Wharf C, Norfolk.

Barges, Nashville, Tenn.—Penn Bridge Company, Beaver Falls, Pa., received the contract for fourteen steel barges for U. S. Engineer Office, Nashville. Price, $156,535.

Removing Wreck, Buffalo, N. Y.—Sealed proposals were received on March 10 for removing wreck of steamer Arizona from St. Lawrence River at Cape Vincent, N. Y.

Survey Boat, Jacksonville, Fla.—The Burger Boat Company, Manitowoc, Wis., was awarded the contract by U. S. Engineer, Jacksonville, for one motor survey boat. Price, $4,925.

Gates, Cincinnati, O.—Sealed proposals were received on March 28 by U. S. Engineer, Cincinnati, for furnishing, delivering and erecting gates for Locks 36, 38 and 44, Ohio River.

Dredging, New Orleans, La.—U. S. Engineer Office, New Orleans, will receive sealed proposals until April 9 for dredging Intracoastal Waterway between Bayou Black and Bayou Terrebonne, La.

Acetylene Cylinders, Staten Island, N. Y.—Sealed proposals were received by Superintendent of Lighthouses, Staten Island, on March 29, for furnishing 450 seamless drawn steel acetylene cylinders.

Dredging, Galveston, Tex.—The contract for dredging channels at Brazos Island Harbor was awarded by the U. S. Engineer, Galveston, to J. Jacobson, 2217 Avenue C, Galveston. $181,200.

Dredging, Galveston, Tex.—U. S. Engineer awarded the contract for dredging 30-foot project in Houston Ship Channel to United Dredging Company, 233 Broadway, New York City, at a price of $350,000.

Dredging, Honolulu, H. T.—U. S. Engineer awarded the contract for dredging in Honolulu Harbor, 1,250,000 cubic yards excavation, to Hawaiian Dredging Company, 854 Kuhuhuana street. Price $949,540.

Castings, Etc., Florence, Ala.—U. S. Engineer, Florence, awarded the contract for furnishing castings and other parts for regulating gates of Wilson Dam to Charles Ward Engineering Works, Charleston, W. Va. $119,300.

Painting, Repairs, Etc., Staten Island, N. Y.—Sealed proposals were received by the Superintendent of Lighthouses, 3rd District, Staten Island, on March 26, for docking, cleaning, painting and repairing the lighthouse tender Spruce.

Tanks, Florence, Ala.—The contract for furnishing displacement tanks for regulating gates of Wilson Dam was awarded to J. S. Schofield, Hammond and Boundary streets, Macon, Ga., by U. S. Engineer, Florence. Price $136,300.

Dredging Ladder, Cincinnati, O.—U. S. Engineer, Custom House, Cincinnati, awarded the contract for a dredging ladder for 24-inch pipe line dredge to J. and J. B. Milholland Company, 714 Fifth avenue, Pittsburgh, Pa. Price, $35,497.

Contract Awarded, Huntington, W. Va.—U. S. Engineer, Huntington, awarded the contract for constructing and delivering three steel barges to Riter-Conley Manufacturing Company, Leetsdale street, Pittsburgh, Pa. Price $32,190.

Dredging and Rock Removal, Tampa Harbor, Fla.—Sealed proposals will be received by U. S. Engineer Office, Jacksonville, Fla., until 12 M., April 3, 1923, for dredging and rock removal in Tampa Harbor, Fla. Further information on application.

Lock Construction, Newburg, Ind.—U. S. Engineer Office, P. O. Box 72, Louisville, Ky., will receive sealed proposals until 2:00 P. M., central time, April 10, 1923, for constructing Lock No. 47, Ohio River, at Newburg, Ind. Further information on application.

Dredging Pump, Jacksonville, Fla.—United States Engineer Office, Jacksonville, Fla., will receive sealed proposals until 12 M., April 20, 1923, for furnishing and delivering a dredging pump for the United States dredge Barnard. Further information on application.

Dredging and Rock Removal, East River, N. Y.—Sealed proposals will be received by U. S. Engineer Office, Room 710, Army Building, 39 Whitehall street, New York, N. Y., for dredging and rock removal in East River, N. Y. Further information on application.

Painting Piers, Hoboken, N. J.—Bids were received at the office of Commissioner T. V. O'Connor, United States Shipping Board, 45 Broadway, New York City, on March 23, for the work of painting portions of Piers 1, 2 and 3, Shipping Board Terminal, Hoboken, N. J.

Manila Rope, Memphis, Tenn.—Sealed proposals will be received by Mississippi River Commission, 1st and 2nd Districts, Custom House, Memphis, until 11 A. M., April 3, 1923, for furnishing and delivering approximately 103,000 pounds of Manila rope. Further information on application.

Galvanized Wire, Etc., Memphis, Tenn.—Proposals were received at the office of the Mississippi River Commission, 1st and 2nd District, Custom House, Memphis, on March 26, for furnishing and delivering 870,000 pounds of galvanized wire, wire strand, and staples, and 24,000 wire rope clips.

Steel Sheet Piling, Louisville, Ky.—Sealed proposals will be received by U. S. Engineer Office, P. O. Box 72, Louisville, Ky., until 2 P. M., cen-

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tral time, April 5, 1923, for furnishing and delivering steel sheet piling for Dam No. 44, Ohio River. Further information on application.

Motor Dredge Tender, San Francisco, Cal.—Sealed proposals will be received at U. S. Engineer Office, San Francisco, until 11 A. M., April 6, 1923, for constructing, testing and delivering ready for operation, one 40-foot motor dredge tender complete. Further information on application.

Concrete Wharf, Etc., New Orleans, La.—Sealed proposals will be received by the Board of Commissioners of the Port of New Orleans at their office, Suite 200, New Court Building, until 3 P. M., April 5, 1923, for concrete wharf, chain walls and column footings for shed at Claiborne Avenue Landing.

Dredging, Norfolk, Va.—Specification 4771.—Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded the contract for dredging approximately 14,000 cubic yards at Navy Yard, Norfolk, to Norfolk Dredging Company, Campostella Wharf. $0.395 per cubic yard, scow measurement (30 days).

Lock Construction, Ohio River.—Sealed proposals will be received by U. S. Engineer Office, P. O. Box 72, Louisville, Ky., until 2:00 P. M., central time, April 10, 1923, for constructing Lock No. 47, Ohio River, at Newburg, Ind. Further information on application.

Dredging, Astoria, Ore.—Specification 4615.—Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded the contract for 400,000 cubic yards of dredging at the Naval Submarine and Destroyer Base, Astoria, to Gilpin Construction Company, foot of Fourteenth street, Astoria; price, $0.15 per cubic yard.

Contracts Awarded, Huntington, W. Va.—U. S. Engineer, Huntington, awarded the following contracts for lock operating machinery, etc., for Dam 30, Ohio River: H. P. Gazzam Machine Company, 3200 Penn avenue, Pittsburgh, Pa., Lot A, $7,995; J. & J. B. Milholland Company, 714 Fifth avenue, Pittsburgh, Pa., Lot C, $6,739. Lots B and D rejected.

Structural Metal for Locks, Etc., Vicksburg, Miss.—U. S. Engineer Office, Drawer 421, Vicksburg, will receive bids until noon, April 7, 1923, for furnishing and delivering about 467,000 pounds of structural metal for locks and dams Nos. 5 and 8, Ouachita River, La. and Ark., and for erecting four steel gates at No. 5 and modifying two steel lock gates at No. 8. Information on application.

Dredging, Etc., Philadelphia, Pa.—Specification 4738 A and B.—Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded the contracts for dredging, filling, wood bulkhead and concrete drain at Philadelphia, to American Dredging Company, 308 Chestnut street, $0.33 per cubic yard; and to McLean Contracting Company, 1415 Fidelity Building, Baltimore, Md. (item 4a), $14,945.

NEW INCORPORATIONS

The Pocahontas Steamship Company, capital $500,000, incorporated under Delaware laws.

The Malston Company, capital $800,000, to operate boats, incorporated under Delaware laws.

Universal Steamship Corporation, of Dover, Del., chartered under Delaware laws, capital $100,000.

The American Export Corporation, of Manhattan, has increased its capitalization from $25,000 to $100,000.

The Colombian Steamship Company, of Wilmington, Del., capital $1,800,000, chartered under Delaware laws.

The Olympus Steamship Corporation, of Manhattan, capital $10,000, chartered at Albany. Incorporators: W. S. Auld, J. J. Binder and S. Brander.

The Algerian-American Shipping Company, capital $50,000, chartered at Albany. Incorporators: George H. Haynor, Jr., E. Jones, and W. D. Greenlees.

The Superior Transportation Company, of Manhattan, capital $50,000, chartered at Albany, to engage in the navigation business. Incorporators: L. J. Lake, J. E. Lee and A. M. Hull.

The Planet Line, of Manhattan, capital $50,000, to engage in ocean commerce, incorporated under New York laws. Incorporators: E. E. Baldwin, F. V. Barnes and R. F. Weeks, attorneys.

Daniel Ripley & Company, capital $100,000, steamship company operating mainly out of Gulf of Mexico ports. The company has moved its headquarters from Galveston to Houston, Tex., a branch office to be maintained at the former port. Walter Terry Smith is president of the new corporation.

John J. Lenahan, of Buffalo, has just become associated with the Cowles Towing Company of that city, and the company has been incorporated under the name of Cowles Towing Line, Inc., capital $50,000. The new company will take over the steel and wooden tugs, derrick boats, lighters and wrecking equipment of the Cowles company, a property valuation of about $150,000. The business will be expanded. Operations will be in Buffalo harbor.

FOREIGN ACTIVITIES

Contract for Steam Colliers.—A contract for two steam colliers for Messrs. France, Fenwick and Company, Ltd., of London, has been secured by Messrs. Vickers, Ltd., of Barrow. The ships are to be 280 feet in length and to have a speed of ten knots.

Passenger Ship Launched.—A finely modeled twin screw steel passenger steamer for the British India Steam Navigation Company, Ltd., has been launched by Swan, Hunter & Wigham Richardson from their Neptune Shipyard, Newcastle-on-Tyne. This vessel, which is 440 feet in length and 55 feet 6 inches in breadth, will be propelled by two four crank triple expansion engines balanced on the Yarrow Schlick & Tweedy system. Steam will be supplied by 8 boilers working under Howden's system of forced draft.

Wear Yards Get New Contracts.—Five new orders for vessels have been recently placed on this river. An 8,000-ton vessel goes to Messrs. W. Pickersgill & Sons, another 8,000-ton ship goes to Messrs. J. Priestman & Co., two 3,300-ton vessels to Sir J. Laing & Sons, and a self-trimming collier of 1,800 tons to Messrs. J. Crown & Sons. Contracts for 40 new vessels have been placed on the Wear during the past few months and practically every shipyard on the river has work in hand.

Moore Line Steamer Launched.—The Orangemoor, fourth of the large steamers to be constructed for the Moore Line by the Northumberland Shipbuilding Company, has been successfully launched at their plant at Howdon-on-Tyne. This vessel is of the shelter deck type and will have a carrying capacity of 9,000 tons deadweight. Her principal dimensions are: Length, 415 feet; breadth, 53 feet; and molded depth, 35 feet 6 inches. The propelling machinery consists of a triple expansion engine built by the North Eastern Marine Engineering Company, Ltd., having cylinders of 27, 45 and 75 inches diameter, and a stroke of 48 inches.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander S. M. Robinson, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Asociation of Engine and Boat Manufacturers
29 West 39th Street, New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

The New York Tow Boat Exchange
11 Moore St., New York.
Secretary—Irving G. Keller.

Port of New York Authority
11 Broadway, New York.
Chairman—E. H. Outerbridge.
Secretary—William Leary.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
President—A. G. Smith.
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
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Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

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Collegio Degli Ingegneri Naval e Meccanici in Italia

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